CIVIL ENGINEERING

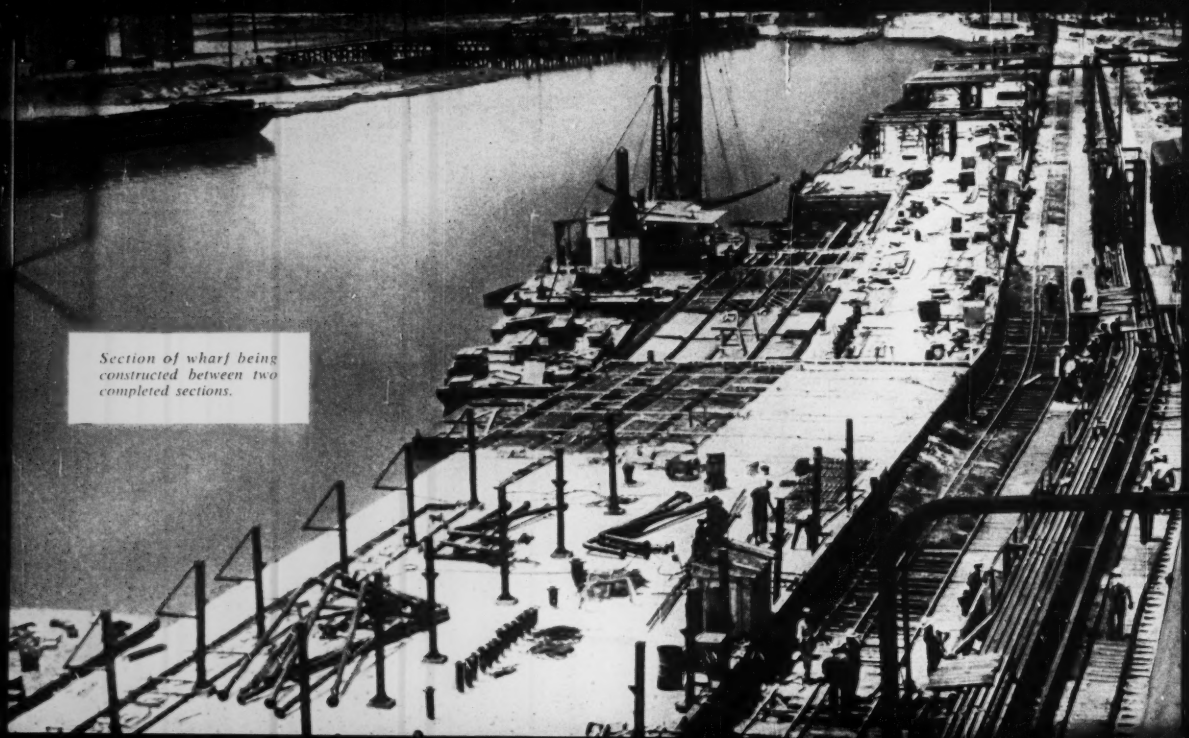
LOS ANGELES BUILDS
2,000-car garage under
Pershing Square. — McMahon

RAYMOND

SERVING GULF OIL FOR 40 YEARS

THROUGH THE YEARS,

RAYMOND



Section of wharf being constructed between two completed sections.

IT'S YOURS

A Free Library on KLEMP open steel meshes

A World of Information about Open Steel Meshes . . . and yours for the asking.

Be sure that your files include this valuable data on open steel meshes. Mail the coupon for any or all of these informative, fully illustrated bulletins.

For more than 44 years the Wm. F. Klemp Company has pioneered in the development and manufacturing of open steel meshes for all industrial applications. Their complete line includes open steel and aluminum grating and treads, ganister lining reinforcement meshes, open steel and aluminum bridge deckings. For the best, most economical answer to your flooring, pipe and vessel lining problems, consult with Wm. F. Klemp Company, 6610 South Melvina Avenue, Chicago 38, Illinois.

SEND COUPON TODAY

WM. F. KLEMP COMPANY
6610 South Melvina Avenue, Chicago 38, Illinois

Dear Sir: Please send me, without obligation, the catalogs checked:

- ☐ Klemp Open Steel Grating and Stair Treads
- ☐ Klemp Acme Floor-Steel
- ☐ Klemp Hexteel
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KLEMP is world's largest manufacturer of open steel meshes

CIVIL ENGINEERING, The Magazine of Engineered Construction, December, 1951. Vol. 21, No. 12. Published monthly by the American Society of Civil Engineers. Publication office 20th and Northampton Streets, Easton, Pa. Editorial and advertising departments at the headquarters of the Society, 33 West 39th Street, New York, N. Y. Price 50¢ a copy, $5.00 a year in advance, $4.00 a year to members and to libraries and $2.50 a year to members of Student Chapters. Canadian postage 75¢ and foreign postage $1.50 additional. Entered as second class matter September 23, 1930, at the Post Office, Easton, Pa., under the Act of August 24, 1912, and accepted for mailing at a special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 5, 1918.

Floodwall of U·S·S Steel Sheet Piling protects Newport Rolling Mill

View of Newport, Ky., flood protection works from across Licking River. Project was built for the U. S. Army Corps of Engineers by Traylor Brothers, Inc. Evansville, Ind.

76 earth-filled cells solve problems of restricted space and unstable sub-stratum

Interconnected earth-filled cells of U·S·S Steel Sheet Piling provide a highly satisfactory solution to the difficulties the U. S. Army Corps of Engineers faced in construction of this floodwall on the Licking River at Newport, Kentucky.

The seven-block long Newport Rolling Mill occupied the logical site for conventional cellular-type construction. High, steep river banks with an unstable stratum of plastic blue clay and silt created conditions unsuitable for a concrete floodwall.

The structure, as completed, consists of 60° arcs of U·S·S Steel Sheet Piling connected by straight diaphragm walls of the same material. The piling in the landward arcs is 73 feet long, top being flush with existing ground surface. Riverward piling—93 feet long—extends to protection grade. A second series of cells have their landward arc 25 to 38 feet riverward of the landward arc of the main cells. They too extend to protection grade and, with the riverward arc, form a second series of cells atop the main cells.

12,309 tons of U·S·S Steel Piling are used in the 76 cells that make up this floodwall structure.

Completed earth-filled cells form flood protection works that guard Newport Rolling Mill, in background, against high waters in the Ohio River Flood Basin.

You can't beat U·S·S Steel Sheet Piling for retaining and controlling earth and water

Because of its great strength, long life and low installation and maintenance costs, U·S·S Steel Sheet Piling has proved invaluable in all types of projects involving retention and control of earth and water.

Assembled in easily-driven units that positively interlock to the next, U·S·S Steel Sheet Piling forms a continuous wall that confines soil and that can be made practically watertight. Available in straight-web, arch-web, and "Z" sections, U·S·S Steel Sheet Piling is shipped as a finished product, ready to be handled and driven under the most difficult conditions of soil, water or surf.

USS TRADE MARK

UNITED STATES STEEL COMPANY, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO

TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

STEEL SHEET PILING

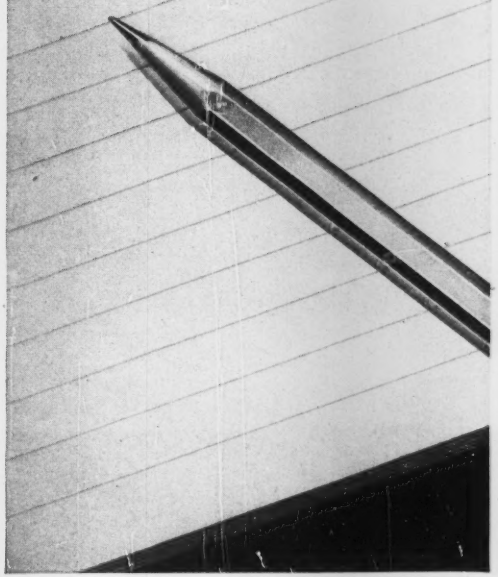
1-914-A

UNITED STATES STEEL

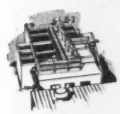
A Good Way to Remove Water Impurities
PERMUTIT PRECIPITATOR

Operating Advantages:

1. SAVES UP TO 40% IN CHEMICALS.
2. SAVES UP TO 50% IN SPACE.
3. SAVES UP TO 75% IN TIME.
4. KEEPS SLUDGE FRESH, ACTIVE—WITH NO SETTLING.
5. ADAPTS TO VARIABLE FLOWS.



HOW IT WORKS:



The Precipitator operates on the principles of precipitation, absorption, settling, and upward filtration. It is adaptable for water softening, removal of turbidity, color, taste, odor, alkalinity, silica, and fluorides.

Precipitator capacities range from 1,000 gals. per day to 10,000,000 gals. per day. Batteries handling up to 120,000,000 gals. per day are currently in use in some municipalities.

Write for free bulletin to The Permutit Company, Dept. C-12, 330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

PERMUTIT®

WATER CONDITIONING HEADQUARTERS FOR OVER 38 YEARS

A "Grand National" Winner... like Cast Iron Pipe...has

The Grand National Steeplechase, over a course of about 4½ miles with 30 jumps, is a rugged test of the *stamina* of a horse. Likewise, the test of time proves the *stamina* of cast iron pipe. For example, in more than 30 of the older American cities, cast iron water and gas mains are now in their second century of service. These sturdy mains are meeting changed conditions undreamed-of 100 years ago—in street traffic and in construction aboveground and underground. The resultant traffic shock and beam-stresses, cast iron pipe has taken in its stride, because of its shock-strength, beam-strength and crushing-strength.

No pipe, deficient in any of these strength-factors of long life, should ever be laid in paved streets of cities, towns and villages.

CAST IRON PIPE

STAMINA!*

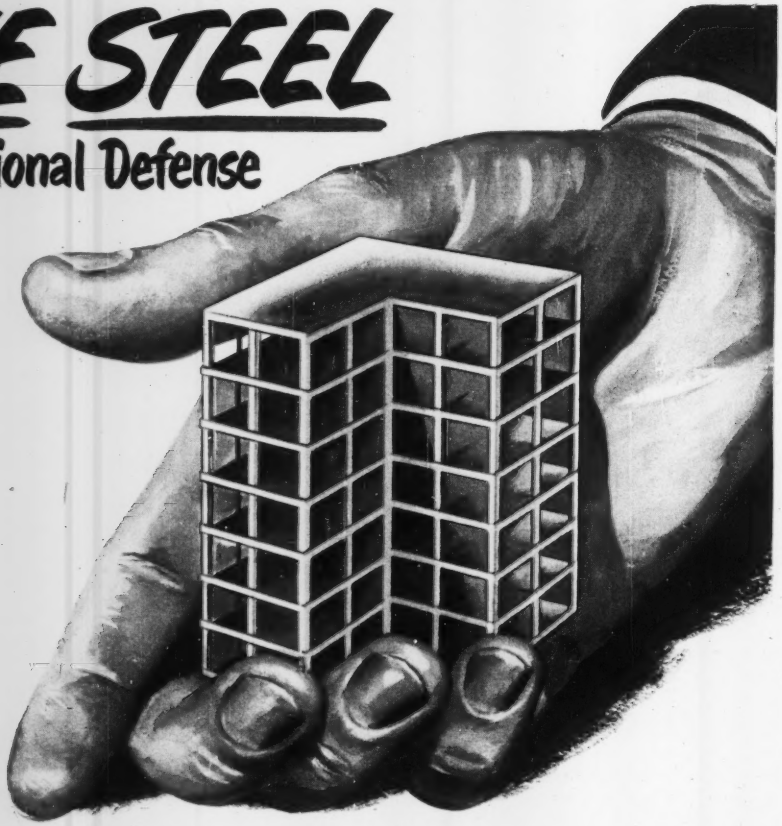
* First run in England 112 years ago, the Grand National Steeplechase, over the famous Aintree course of 4 miles, 856 yards, was won in the record time of 9.20-2/5 by Golden Miller in 1934.

CAST IRON

CAST IRON PIPE RESEARCH ASSOCIATION; THOS. F. WOLFE, MANAGING DIRECTOR. 122 SO. MICHIGAN AVE., CHICAGO 3.

SERVES FOR CENTURIES

SAVE STEEL
for National Defense



...Build with REINFORCED CONCRETE

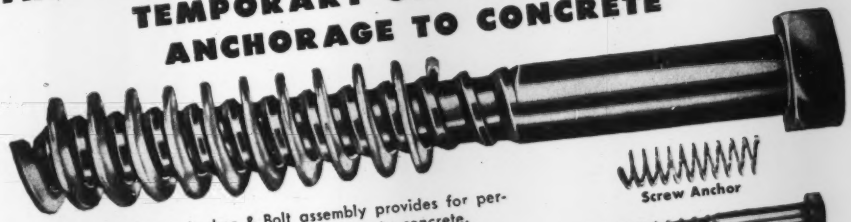
Steel is one of our most critical war materials. You can stretch your steel allotment by designing your buildings and engineering structures for reinforced concrete.

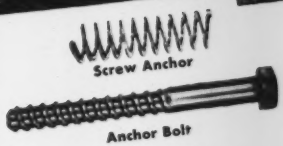
Reinforced concrete brings you many other advantages, too. Reinforced concrete framing is low in cost and fast to complete—often providing extra months of rental income. Furthermore, reinforced concrete is inherently fire-safe. It provides a rugged, durable structure, highly resistant to wind, shock, and quakes. On your next structure, *design for reinforced concrete.*

CONCRETE REINFORCING STEEL INSTITUTE
38 S. Dearborn St., Chicago 3, Illinois

ENGINEERED TYING DEVICES, ANCHORAGES and ACCESSORIES for CONCRETE CONSTRUCTION

THIS ANCHOR BOLT DEVICE PROVIDES FOR TEMPORARY OR PERMANENT ANCHORAGE TO CONCRETE



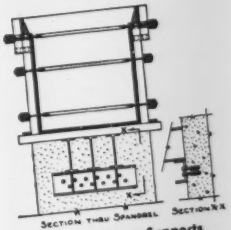


The Richmond Screw Anchor & Bolt assembly provides for permanent or temporary, cast-in-place anchorage to concrete.

The Screw Anchor unit embedded in concrete distributes the load from the coarse threaded anchor bolt which is removable and reusable as required.

Use for permanent anchorage provides full bolt strength for securing fixtures to concrete such as cleats and fender systems for docks, column bases for steel structures, seat brackets for stadiums, etc.

Use for temporary installations includes tunnel form anchorage to previously poured inverts; anchorage of cantilever lift forms in dam construction; pile lifting with Anchor Eye Bolts; and anchorage of bracket supports for overhead form structures to eliminate costly shoring and bracing.



Spandrel Beam Supports
A few Anchors and Bolts to support heavy spandrel beam forms to concrete piers replace expensive high level shoring.

HERE'S THE BABE THEY JUST ELECTED QUEEN AT THE FORM STRIPPERS' CONVENTION.
WOW! SHE'S SURE LIVIN' UP TO HER TITLE!
TY
INSIST ON RICHMOND
... AND BE SURE IT'S RICHMOND!
Richmond
SCREW ANCHOR CO., INC.
816-838 LIBERTY AVENUE · BROOKLYN 8, N. Y.

Get your "Screwy" or "TY" button—write to Jack Bennett at Richmond, 816 Liberty Ave., Brooklyn 8, N. Y.

RICHMOND KNOW-HOW—DEPENDABILITY—SERVICE—ESTIMATES & JOB PLANNING

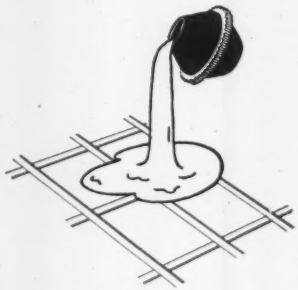
For the toughest drainage jobs... concrete pipe reinforced with **American Welded Wire Fabric**

ON the nation's highways, railroads and airports, the tremendous volume of surface run off is handled most efficiently by reinforced concrete pipe. In water supply and sewer systems, too, reinforced concrete pipe handles the volume, withstands the pressure, maintains effective leakage limits.

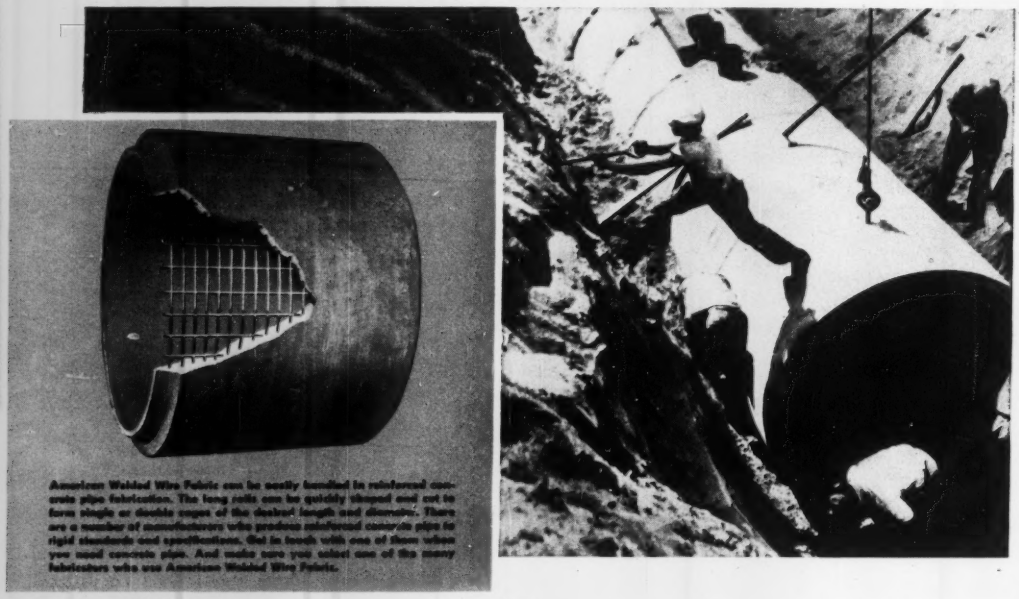
Prominent fabricators have established uniform specifications for the manufacture of reinforced concrete pipe. Those specifications meet the standards set by the A.S.T.M. And an impressive proportion of the industry's output is reinforced with American Welded Wire Fabric, the *reinforcement* for concrete that meets all A.S.T.M. requirements.

American Welded Wire Fabric distributes the strength of high yield point steel throughout all parts of the pipe and forms a perfect bond with concrete. The welded fabric can be quickly and easily shaped into cages to fit molds that produce pipe sections of various diameters and lengths. The reinforcement stays in place during pouring and tamping.

So, when you are planning projects that require reinforced concrete pipe, be sure the pipe you get is reinforced with U·S·S American Welded Wire Fabric.



AMERICAN STEEL & WIRE COMPANY, GEN. OFFICES: CLEVELAND
COLUMBIA STEEL COMPANY, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



American Welded Wire Fabric can be easily handled in reinforced concrete pipe fabrication. The long rolls can be quickly shaped and cut to form single or double cages of the desired length and diameter. There are a number of manufacturers who produce reinforced concrete pipe to rigid standards and specifications. Get in touch with one of them when you need concrete pipe. And make sure you select one of the many fabricators who use American Welded Wire Fabric.

Every type of concrete construction needs

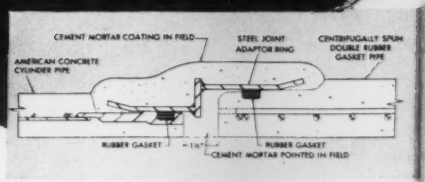
AMERICAN WELDED WIRE FABRIC
reinforcement

USS

UNITED STATES STEEL

A Money-Saving Combination!

Wherever Pressure Conditions Permit-- Different Classes of American Reinforced Concrete Pressure Pipe Can Be Combined in the Same Water Transmission Line


CEMENT MORTAR COATING IN FIELD
STEEL JOINT ADAPTOR RING
CENTRIFUGALLY SPUN DOUBLE RUBBER GASKET PIPE
AMERICAN CONCRETE CYLINDER PIPE
RUBBER GASKET
RUBBER GASKET
CEMENT MORTAR POINTED IN FIELD

Here's a typical example of the ability of American to meet specific project requirements... to give you a carefully laid out and engineered pipe line. You'll like the simplified planning and ease of installation this feature gives you.

By designing your pipe line to meet such specific project requirements you will achieve...

Greater Economy in Cost!

You know that reinforced concrete pressure pipe gives you the strength of steel and the permanence of concrete... with reductions in initial cost, lower installation costs, sustained capacity, and trouble-free service. Four classes of reinforced concrete pressure pipe are available to meet varying requirements.

So why not use the proper combination of these classes of pipe, where pressure ranges differ, to meet the needs not only of high pressure service but the needs of intermediate and low pressure service as well?

You'll find it the most economical way to plan a major capital investment...

...with Greater Savings in Critical Materials!

The conservative design principles of reinforced concrete pressure pipe are such that economical use may be made of steel and concrete to meet design requirements with appreciable savings in critical materials.

During the present defense emergency, these are valuable savings to make... and, they are savings that ease the problems of procurement, with less drain on the national economy.

So... if you find that the pressure ranges in your line are going to differ widely, give us the opportunity to show you how the combination of different classes of American reinforced concrete pressure pipe can save you money.

How American Concrete Cylinder Pipe Is Joined To American Non-Cylinder Pressure Pipe

A simple adaptor ring provides the transition between the spigot ends of two different classes of pipe.

In all classes of reinforced concrete pressure pipe manufactured by American, the rubber gasket is confined by a joint ring to a definite groove in the spigot end of the pipe, thus assuring the most positive and safest use of the gasket as a water seal under all normal operating conditions.

Recent Typical Installations Where This Feature Is Being Used to Obtain REDUCTIONS IN THE COST OF DELIVERED WATER

San Dieguito Irrigation District, Encinitas, California

City of Whittier, California

City of Pasadena, California

Pomona Valley Municipal Water District (now being installed) Pomona, California

Four Plants to Serve You

American manufactures four classes of reinforced concrete pressure pipe in diameters ranging from 12 in. to 12 ft., and for all pressures related to to modern American waterworks practice.

American PIPE AND CONSTRUCTION CO.

Concrete Pipe for Main Water Supply Lines, Storm and Sanitary Sewers, Subaqueous Pipe Lines
P. O. Box 3428, Terminal Annex, Los Angeles 54, California

MAIN OFFICES AND PLANT—4635 FIRESTONE BOULEVARD, SOUTH GATE, CALIFORNIA
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Freedom to work "IN THE DRY"

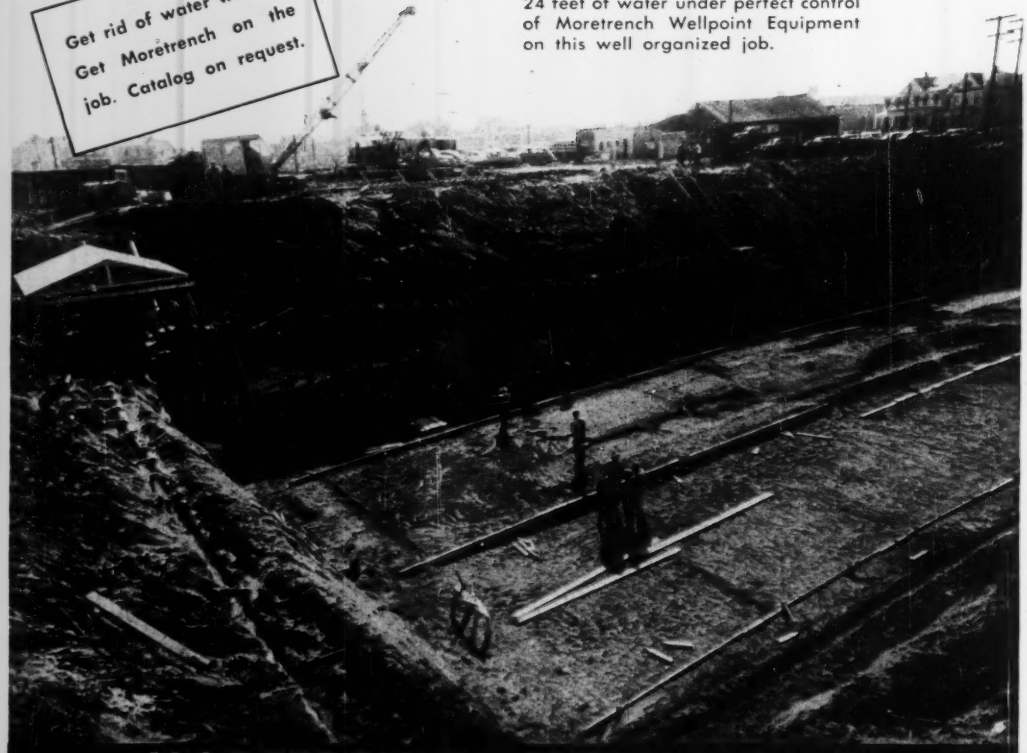
. . . another reason why a MORETRENCH WELLPOINT SYSTEM is the preferred way to solve a pumping problem.

It guarantees your freedom —

to *work* unhampered by water
to *excavate* by whatever method you choose
to *progress* as fast as you can
to *save* while you're doing it.

Get rid of water worries. Get Moretrench on the job. Catalog on request.

24 feet of water under perfect control of Moretrench Wellpoint Equipment on this well organized job.



MORETRENCH CORPORATION

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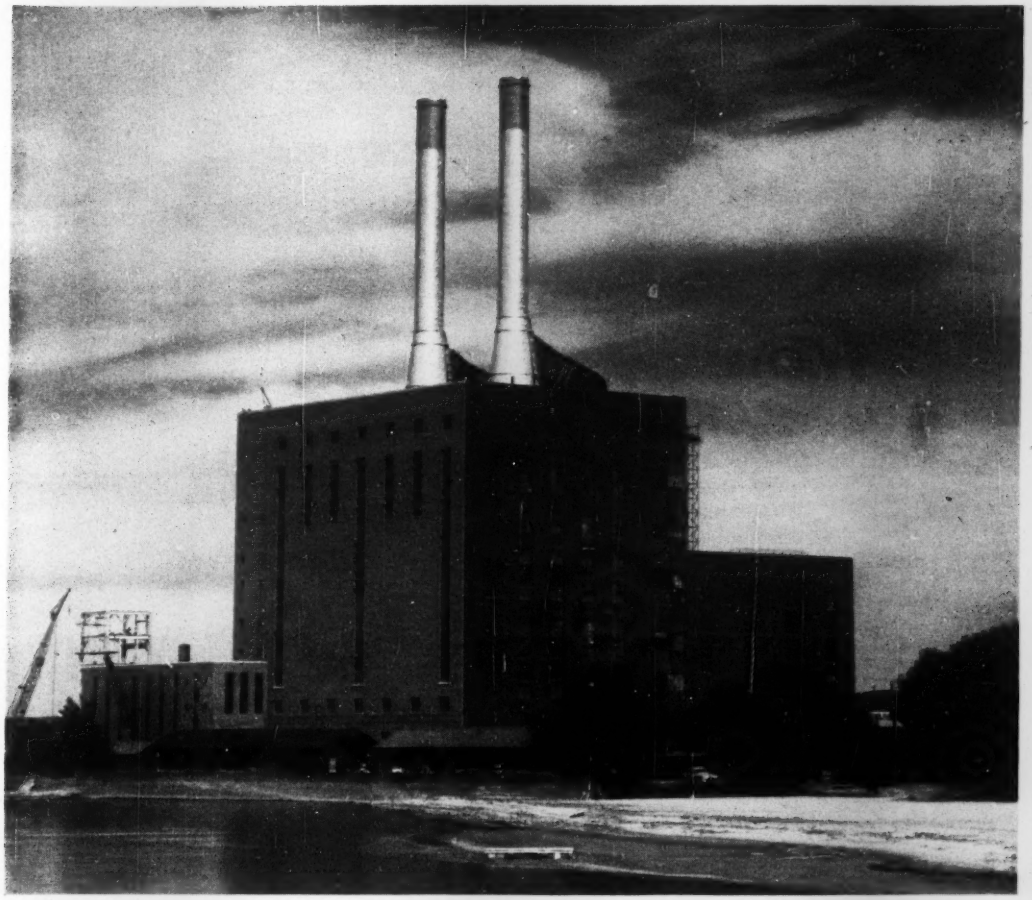

Horton Special Structures Serve Modern Industry

We built these two 13-ft. 6-in. diam. by 150-ft. self-supporting steel smokestacks for the Niagara Mohawk Power Corporation's new station at Dunkirk, New York. The steel from which the stacks were built was pickled and painted by the Phoscote Process, an exclusive Chicago Bridge and Iron Company service that improves the bond between the metal and the paint.

Niagara Mohawk Power Corporation serves practically all of New York State. The Dunkirk station is entirely new and is one of the major generating stations in the vast interconnected network which includes stations in Tonawanda and Oswego, New York. The Oswego station, incidentally, has four Horton steel smokestacks. The capacity of the Dunkirk station is 160,000 K.W. and is so designed that additional power units can be added.

Large field-erected smokestacks are typical examples of the specialized steel plate structures we can furnish to meet the requirements of a particular plant or industry. We are equipped to X-ray and stress-relieve vessels when specified.

We invite you to take advantage of our design, fabrication and erection facilities. Write our nearest office for quotations whenever you need steel plate work of any kind.

CHICAGO BRIDGE & IRON COMPANY

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Cleveland 15. . . . . 2263 Guildhall Bldg.
Detroit 26. . . . . 1541 Lafayette Bldg.
Houston 2. . . . 2128 National Standard Bldg.
Los Angeles 14. . 1556 General Petroleum Bldg.
New York 6. . . . . 3395—165 Broadway Bldg.
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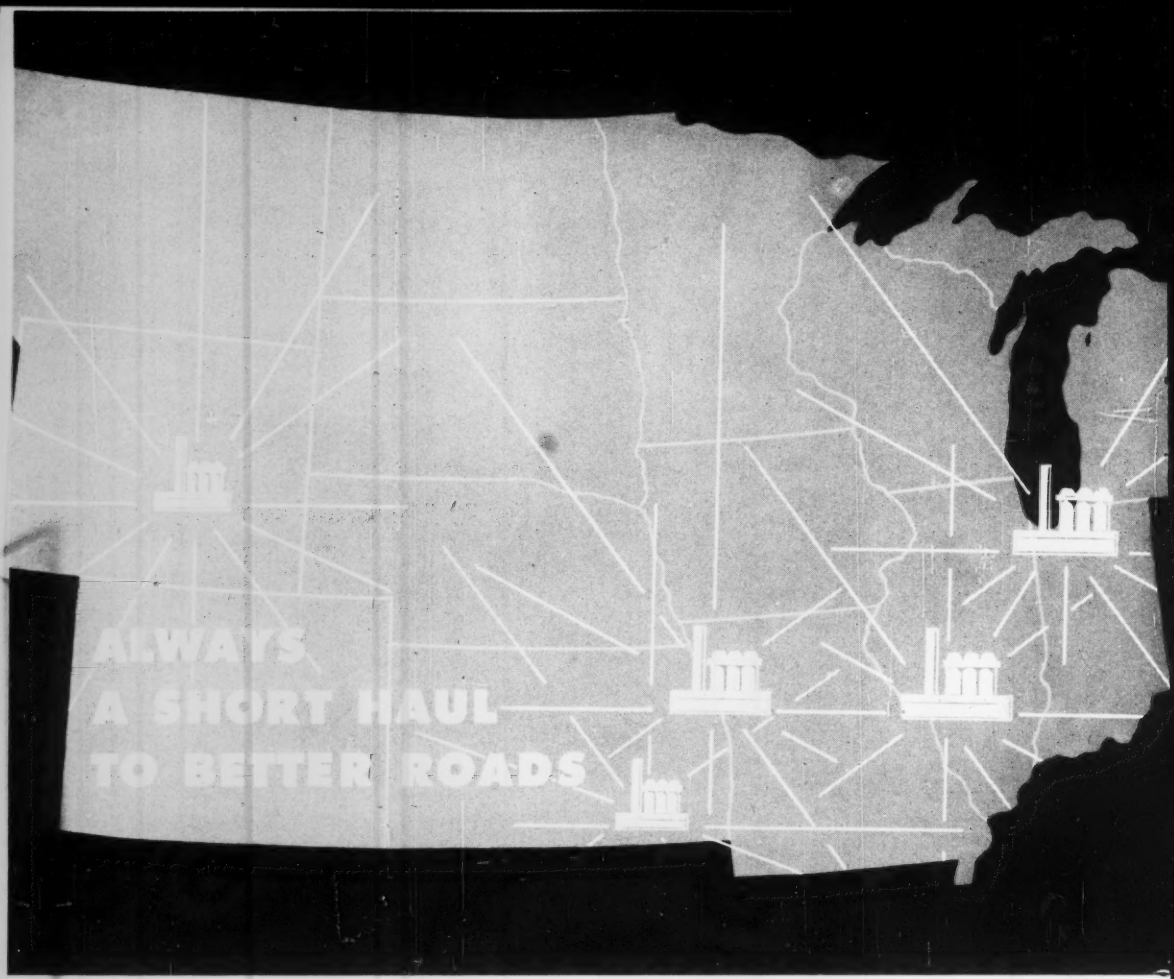
Tulsa 3. . . . . 1647 Hunt Bldg.
Washington 6, D.C. . . . . 1156 Cafritz Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNA.



From one of Standard's 5 Midwest Refineries

Take the advantages of asphalt road construction or resurfacing . . . quick laying, easy upkeep, low cost, long service, use of local aggregate . . . and add the availability of Standard Oil asphalt. That's the answer to road building problems for highways and municipal streets alike.

With five asphalt-producing refineries strategically located throughout the Midwest, Standard offers worthwhile savings in shipping time and freight costs. A Standard Asphalt Representative will help you take advantage of this short haul to better roads —to smooth, glare-free, safe roads.

Call on him too, for help in selecting the type of asphalt construction best suited to your needs and local conditions. For the services of a Standard Asphalt Representative, write:

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

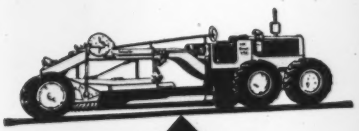
STANDARD OIL
ASPHALT

STANDARD OIL COMPANY STANDARD *(Indiana)*

This Klock Construction Company's "Cat" No. 212 Grader is grading for sidewalk at the municipal football stadium in Amarillo, Texas. Does subgrade, shoulder work and drainage. D. W. Klock says, "This rig is the backbone of our street, alley and parking area work in Amarillo. It's well balanced, and just the right size. Going to buy another just like it this year!"

Buy balanced "Cat" Graders

for more work at less cost



SPEED
WEIGHT
POWER

CATERPILLAR
REG U S PAT OFF

DIESEL ENGINES • TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

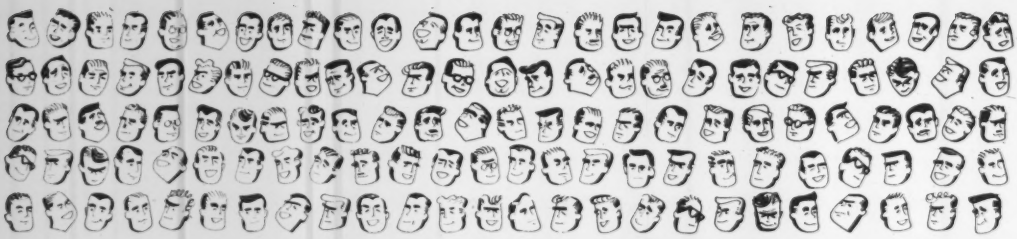
The "Cat" No. 212 Grader shown here will never be a wallflower. Owner D. W. Klock, Amarillo, Texas, says, "This rig's so well balanced, maneuverable and fast, the boys all want to run it!"

Balance is the secret of "Cat" Graders' popularity with owner and operator alike. "Caterpillar" builds each Motor Grader from the ground up as an individual unit. The correct weight, plus the right horsepower, plus rated work speed – these things add up to *balanced* machines that solve your job problems at lower cost.

Informed buyers are finding that *assembled* graders are often poorly balanced. It stands to reason that when one engine or one frame is used for more than one model, the best use cannot be made of weight and power. But balanced "Cat" rigs are neither muscle-bound nor jumpy on the job, and cut costs through superior performance and longer service life.

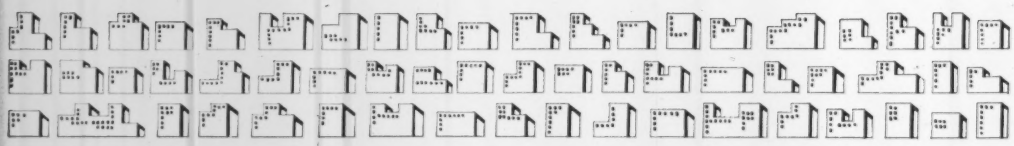
There's a size "Cat" Motor Grader for every type of work – with the stamina, punch and balance to do a particular job best. And don't forget what world-famous "Caterpillar" dealer service means in cutting down time to the bone. Their representatives have plenty of job-savvy, and their parts replacement service is without an equal. Ask your "Caterpillar" dealer to show you his Motor Graders' bonus features. And remember that quality under the hide doesn't show on the outside – it shows up in performance.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS



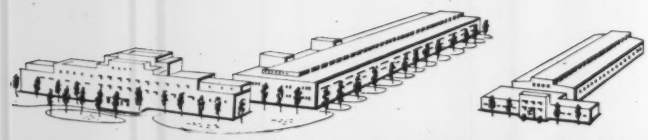
257 FIELD REPRESENTATIVES

48 INSTALLATION INSTRUCTORS



58 SALES OFFICES

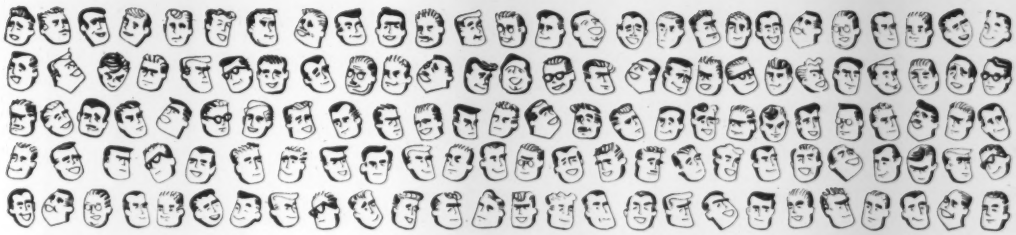
5 MANUFACTURING LOCATIONS



THE LARGEST RESEARCH CENTER OF ITS KIND

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville



At your service—

. . . a complete, nationwide TRANSITE PIPE ORGANIZATION

Here is an organization which, over the past many years, has helped to bring a better, a more efficient and a more economical means of water transportation to many hundreds of American cities and towns.

Its facilities include more than 250 field representatives with headquarters in 58 cities. It also comprises a staff of competent installation instructors who explain recommended installation practices to pipe-laying crews. This Johns-Manville service is an important factor in helping to assure the installation economies as well as the long-term *overall* economies that go with Transite Pressure Pipe.

Behind this field organization are the modern production methods which assure the high quality of the finished product. These begin with careful selection of raw materials and are continued through the special processing operations to the final tests which each individual length of pipe must undergo before shipment is made. Five conveniently located plants now serve Transite Pipe users from coast to coast.

And back of all this is engineering—and research. For without them, the plus values that have been built into Transite Pipe would not have been possible. Today, in the new J-M Research Center, the engineer and the technician continue to find new answers to old problems. Their work is an indispensable part of the complete Transite Pipe service which Johns-Manville offers the water works industry. For further information, write Johns-Manville, Box 290, New York 16, N. Y.

*TRANSITE is a Johns-Manville registered trade mark

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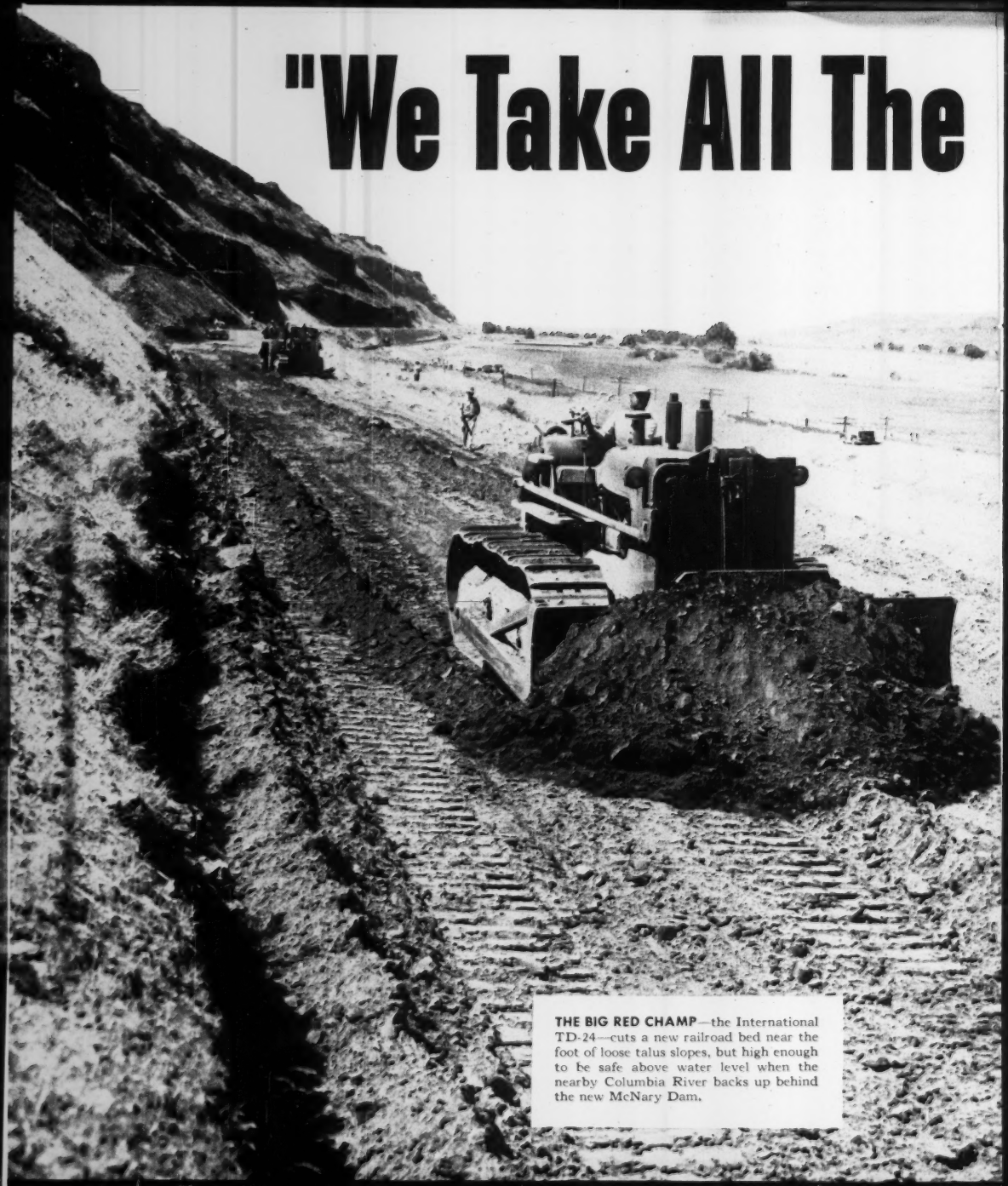
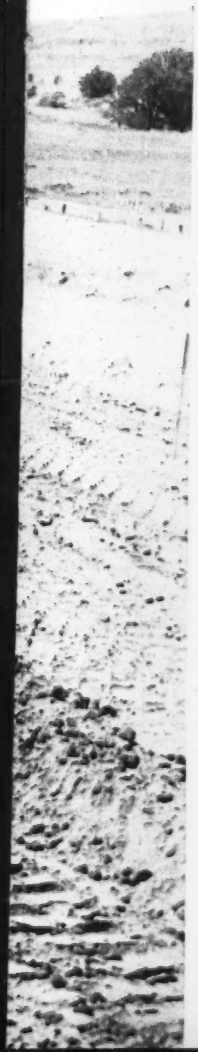


THE BIG RED CHAMP—the International TD-24—cuts a new railroad bed near the foot of loose talus slopes, but high enough to be safe above water level when the nearby Columbia River backs up behind the new McNary Dam.

TOUGH JOBS"

One man and his Big Red TD-24 handle hardest assignments for western contractor



Out on the big Union Pacific relocation job north of the McNary Dam site, Cardon & Cox—subcontracting for Utah Construction Co.—have an International TD-24 shuttling back and forth from one end of their section of the project to the other, doing the hardest jobs wherever they may be.

TD-24 operator Wilbur Strootman says, "We take all the tough assignments, and do them faster and better than any other tractor on the job. This TD-24 is the best tractor I've ever been on. I really go for it."

Here are five big reasons why—five advantages that make the Big Red TD-24 the work champ of the world:

TD-24 Power—148 maximum drawbar horsepower, more than any other crawler on the market.

TD-24 Speed—8 forward speeds, 8 reverse. Moves loads faster, gets back faster for a faster work cycle.

TD-24 Operation—Synchromesh transmission, you shift "on-the-go." And you go up or down one speed without declutching.

TD-24 Steering—Fingertip steering for pivot turns, feathered turns, turns with power on both tracks.

TD-24 Starting—Quick push-button starting in any weather.

Want to know more? Ask a friend who owns a TD-24. And ask your International Industrial Distributor both about the TD-24 and about his fast field service and complete shop facilities. You'll be a TD-24 man from then on in!

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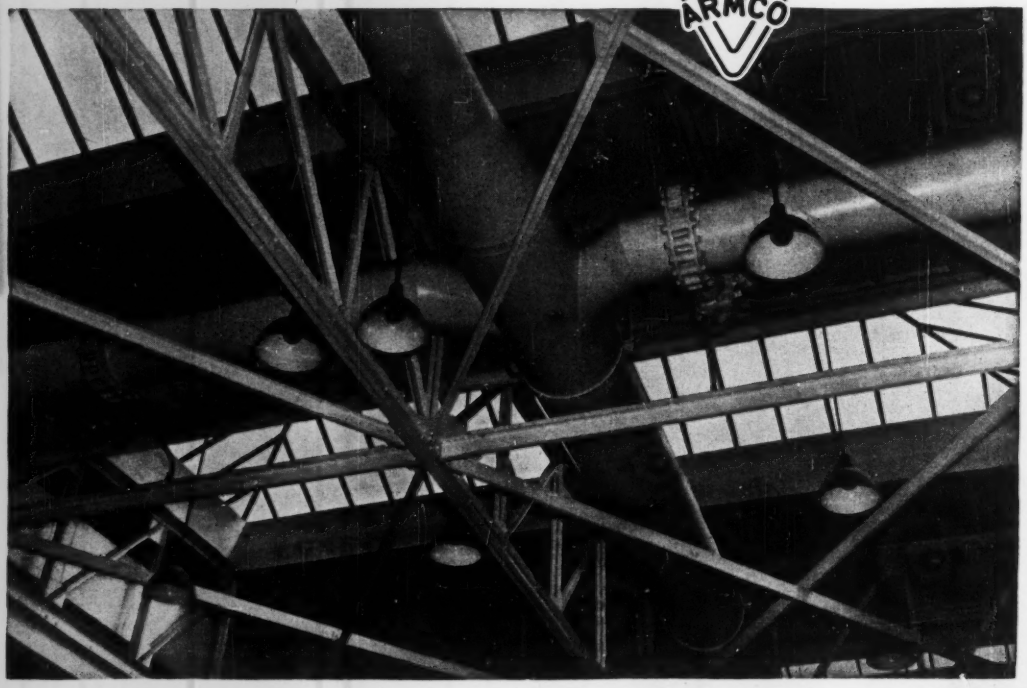
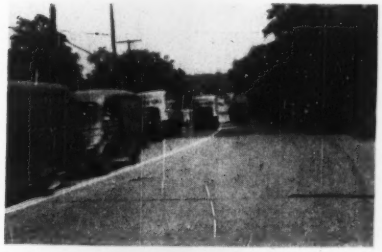


Where paving meets one of its severest tests . . .

Boston Post Road

Above photographs show resilient, heavy-duty Texaco Asphaltic Concrete being laid on the Boston Post Road in the Village of Mamaroneck, N. Y. View of the completed pavement at the right. Contractors: Peckham Road Corporation, White Plains, N. Y., and Cold Mix, Inc., Port Chester, N. Y.



Boston Post Road in Old Greenwich, Conn. Also served by Texaco Asphaltic Concrete paving, which was laid in 1948.

Main truck route between New York City and Boston, the Boston Post Road is one of America's most important highways. The pavement constructed on this road must stand up under the heaviest kind of impact day after day, year in and year out.

Resilient, heavy-duty Texaco Asphaltic Concrete, whose rugged durability has been demonstrated on other sections of the Post Road, was used this year on a two mile section of the route in the village of Mamaroneck, N. Y.

Wherever heavy traffic must be served—principal city streets, trunk highways, bridges or vehicular tunnels—heavy-duty Texaco Asphaltic Concrete is a sound choice. Its past performance on the Boston Post Road, the Delaware River Bridge at Philadelphia and many sections of U. S. Route 1, for example, furnish convincing proof of its ability not only to stand up under punishing impact, but to do so at a relatively low annual cost.

Helpful information on Texaco Asphaltic Concrete, as well as other plant-mixed types of asphalt construction, is provided in a booklet entitled, "Texaco Asphalt Paving—Plant-mixed Types." Our nearest office will send you a copy without cost or obligation to you.

THE TEXAS COMPANY, Asphalt Sales Dept., 135 E. 42nd Street, New York City 17

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OPERATING GUARANTEES EXCEEDED ON EVERY COUNT

by Dorrco Hydro-Treators* at Miami's new Southwest plant.

here are the facts...

In May 1951, the four 69′ dia. Dorrco Hydro-Treators installed at the City of Miami's new softening plant near Coral Gables were put in operation. Complete operating results now available show that guarantees have been exceeded on every count.

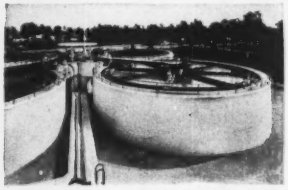
	GUARANTEED	ACTUAL
Capacity—MGD/unit—maximum	13.33	17.5
Turbidity—ppm at maximum flow	10.0	Less than 8
—ppm at average flow	5-10	±2
Percent solids in sludge	30	45-48
Power required/unit—KW	2.0	1.74
pH	**10.0	9.8-10.2
Alkalinity-Phenolphthalein—ppm	**20.0	±1
Methyl Orange—ppm	**40.0	23
Total Hardness	**79.0	45
Activated silica as reagent—ppm	**4	2

Stable effluent is being produced by Hydro-Treator without further treatment.

** Estimated at time of bidding.

We believe these results speak for themselves. If you'd like further information on Hydro-Treators write for Bulletin #9041 . . . 28 pages of drawings, description and useful data. Please address your request to The Dorr Company, Engineers, Stamford, Conn.: or in Canada, The Dorr Company, 80 Richmond Street West, Toronto 1.

* Reg. U.S. Pat. Off.



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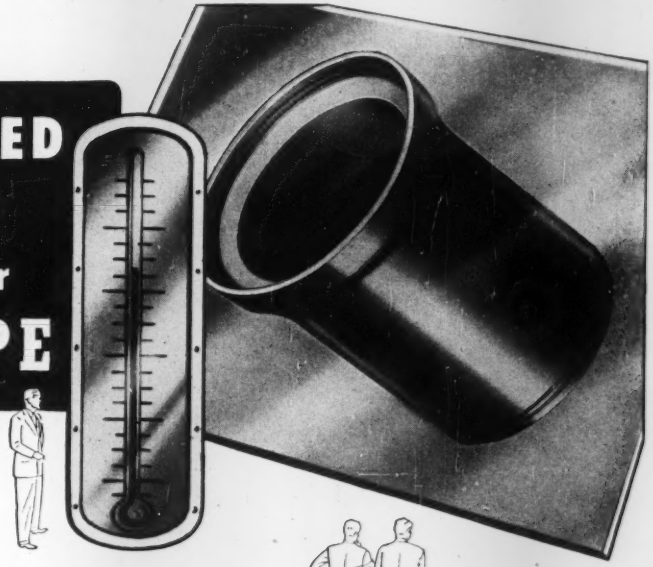

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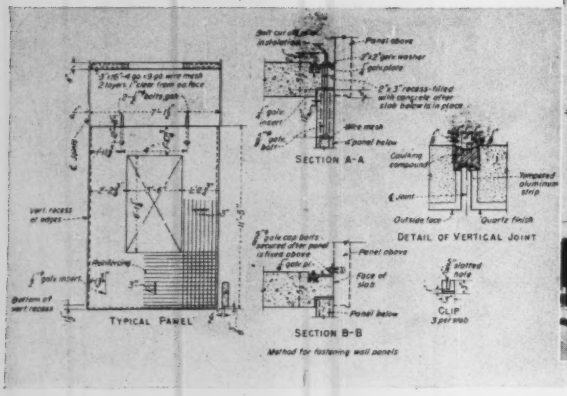
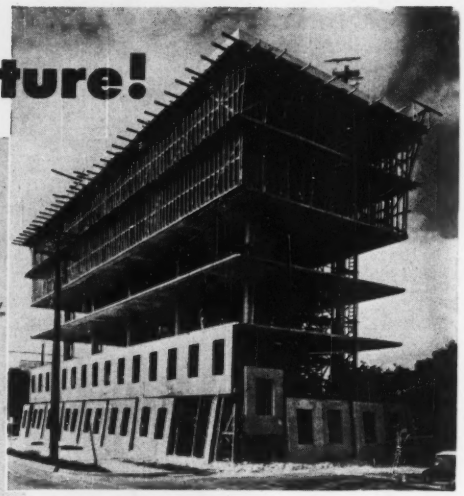




PANEL CONSTRUCTION OFFERS WIDE RANGE OF POSSIBILITIES

'INCOR' 24-HOUR CEMENT used in precast panels for MIAMI'S FIVE-FIFTY BUILDING

● Panel construction—lightweight aggregate or sandwich wall—is spreading rapidly.

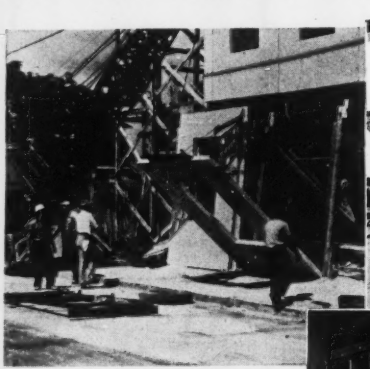
This new building in Miami has story-high, 4-in.-thick, precast wall panels of lightweight concrete, supported from floor above by bolts cast in top edge of slab. Lower edges are secured to edge of floor by angle clips. Vertical joints are closed from the back by spring-aluminum strips snapped into dovetail joints, then caulked from behind. Interior wall back-up is 2" glazed tile.

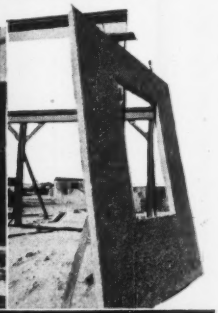
A reinforced-concrete utility shaft houses the elevators, stairs and service facilities, and carries wind-load stresses, in a structure built to withstand a 175-mph hurricane. Precast panels made spandrel walls unnecessary.

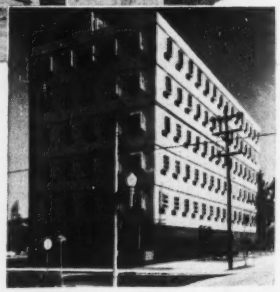
The precision-made wall panels were cast face down with 'Incor' concrete, using pumice aggregate for weight reduction—quartz aggregate and white cement for facing.

Fast, thorough 'Incor'* curing minimizes costly form requirements, assures high strength, early and ultimate . . . at lowest initial and annual cost!

*Reg. U. S. Pat. Off.







FIVE-FIFTY OFFICE BUILDING
Brickell Ave. bet. S. E. 5th & S. E. 6th Sts., Miami
Owner: **FIVE-FIFTY INC.**
Architect:
ROBERT LAW WEED & ASSOCIATES
Structural Engineers:
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VOLUME 21

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DECEMBER 1951

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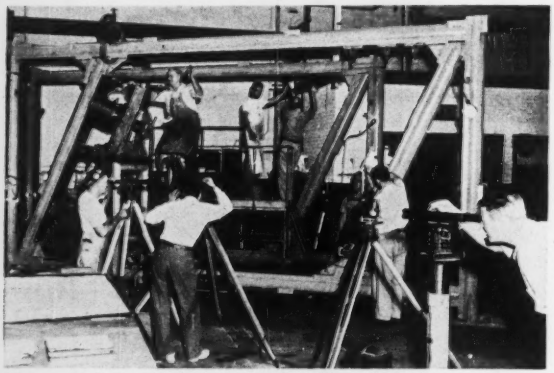
The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

Jet Plane Assembly: Another Job for Transits



Grumman aligns a jig for jet wing assembly with Gurley instruments.

"A surveyor might be surprised to see his field tools, the transit and level, at work in the daily routine of an aircraft plant," says James Caputo, jig inspector at Grumman Aircraft Engineering Corporation. "These instruments are important tools to us, too, in building the accurate jigs on which planes like Grumman's Panther jets are mass assembled.

"Grumman has been using surveying instruments for optical tooling in jig construction since 1940. I have yet to face an alignment problem that a transit-level combination cannot solve. At least two transits and one level are used to establish lines on each jig. It often takes several months to set master parts on a large new jig, but only a few weeks are needed to make duplicates.

Jet Age transitman: Jim Caputo, jig inspector.

"Sometimes as many as 100 different jigs, large and small, are used in the assembly of a single plane. Grumman uses progressive inspection—checking each part as it is set.

"After careful assembly at Grumman, many of our jigs are torn down and reassembled at points 'round the nation. We pride ourselves on the interchangeability of parts—a result of accurate instruments. Inspectors are allowed a tolerance of $\frac{1}{64}$" with transits; but I find Gurley Transits hold to 0.010"—often as low as 0.005". All measurements are done from the center, water, and fuselage reference lines.

"Once in a while, an assembly inspector gets a chance to do some outdoors surveying—laying out a speed course or a new road on the Grumman grounds. When he does, he again chooses a Gurley. As my boss puts it, 'You are only as accurate as your instrument'."

Write for Bulletin 50 giving complete details on Gurley transits, levels and other engineering instruments. And enclose a surveying tip for this page.

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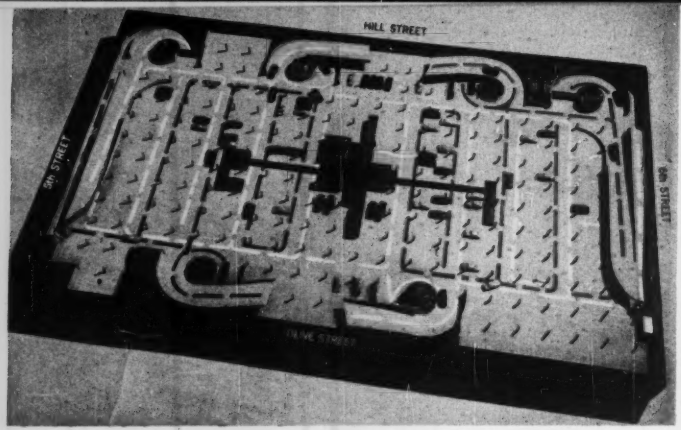
PERSHING SQUARE, site of $5,000,000 City Park Garage, contained statues, walks and a fountain besides a profusion of semi-tropical trees, when excavation began in February 1951. Six months later workmen were parking their cars in a section of the garage 35 ft below street level. Completion is scheduled for early in 1952.

Los Angeles constructs 2,000-car underground garage

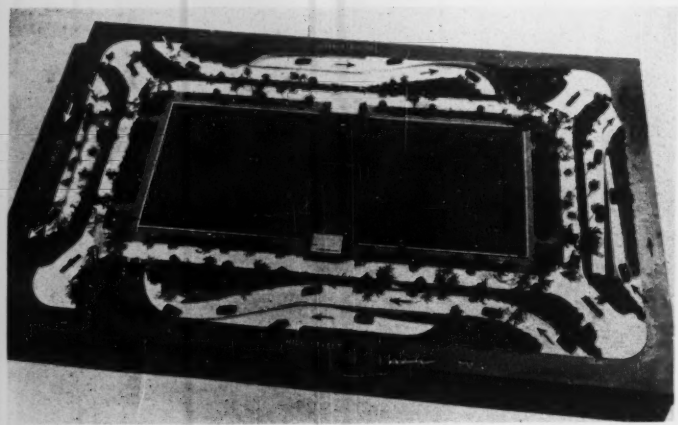
CHARLES A. McMAHON,
Assoc. M. ASCE
Superintendent of Construction,
City Park Garage Project, Los Angeles, Calif

UNIQUE DESIGN features and unusual methods of construction will make it possible, in 1952, for 2,000 cars to be parked at a time under a downtown city park in Los Angeles. Thus about 5,000 cars a day can be accommodated in this underground garage. As a result of twenty years of economic investigation, intensive planning, a willingness on the part of private capital to finance the project, and a charter amendment voted by the citizens in 1947, many car owners will enjoy the convenience of parking in a three-story underground garage in the downtown shopping center, near offices, hotels, and theaters. The story of the conception, design and construction of the City Park Garage project, the world's largest subterranean parking facility, exemplifies what can be done by a group of persevering business men banded together for a common purpose.

The growing need for parking facilities in the downtown areas of cities recently has been recognized as a serious problem, and many cities are starting to do something about it. Since downtown properties are so valuable and vacant sites are so scarce, city planners are beginning to realize the potentialities of the subsurface areas of city parks for garage facilities. The additional space thus created for offstreet parking, besides being a great convenience to the motorist, would result in increased business and a guaranteed income to



MODEL of completed garage has roof removed to show circular entrances and exit ramps, column spacing, and parking positions.



MODEL SHOWS appearance of relandscaped Pershing Square Park after completion of garage, scheduled for early 1952.

EXCAVATION (left), largely of dry alluvial material, was done in two 16-ft passes. Fleet of 45 trucks hauled 250,000 cu yd over city streets to ravine 3 miles from site, utilizing hours from 6 p.m. to 2 a.m. Side slopes were left at 1:1 around edges of excavation. Three boring rigs in foreground are drilling 5-ft-dia holes for precast concrete wall columns. Transit mixer is pouring footing for one column for which hole has already been bored.

the city, all financed by private capital. Almost every recent business, engineering, and construction publication includes an article outlining plans for creating automobile reservoirs by this method. Sacramento, San Francisco, Portland, Chicago, Buffalo, Fort Wayne, New York, and Boston are among the cities that are seriously considering plans for this type of park utilization.

The new parking facility now under construction in Los Angeles is strategically located, as it is bounded by two one-way streets—5th Street on the north and 6th Street on the south—and by two busy two-way streets—Olive Street on the west and Hill Street on the east. Provisions were made for entrance and exit without cutting across any traffic lanes on any of these four streets. Cars will flow in and out of the structure by means of gently sloping circular ramps which connect all three subterranean floors. A 40-car waiting area at each ramp location can be used in rush hours to provide offstreet space for entry to and exit from the garage. To facilitate the quick dispatch of automobiles during the 4:45 to 5:45 afternoon rush hour, the garage is to be operated as six individual parking lots under the control of one manager.

Pedestrian safety was also considered in the design. All the ramps pass under the sidewalks within the park area and provide crossings only at intersections, which are controlled by crosswalk markings and traffic lights. Inside the garage, signs, colored fluorescent lights and colored arrows on the floors will aid motorists as well as garage attendants in directing cars into the desired aisles and to the receiving and dispatching center on the designated floor. At this center the motorist will step from his car, receive a time-stamped parking check, and make his ascent to the surface by one of the two-way escalators, while an experienced attendant parks his car in an available stall. If the motorist so desires, he may have his car washed, polished, and greased during the parking period.

A complete air change is made every six minutes throughout the en-

tire 630,000 sq ft of subterranean area by means of four 60-hp motors connected to 140,000-cfm ventilating fans. The laterals for the duct system are located below the third subfloor slab. Weep holes in the walls of the ducts and pervious backfill material around these ducts provide excellent drainage below the lowest floor level. The water is collected in three 40,000-gal sumps and pumped to the city storm-sewer system by six 10-hp motors connected to six 6-in. centrifugal pumps. Six ejectors lift the sewage from special sumps into the city's sanitary sewer system.

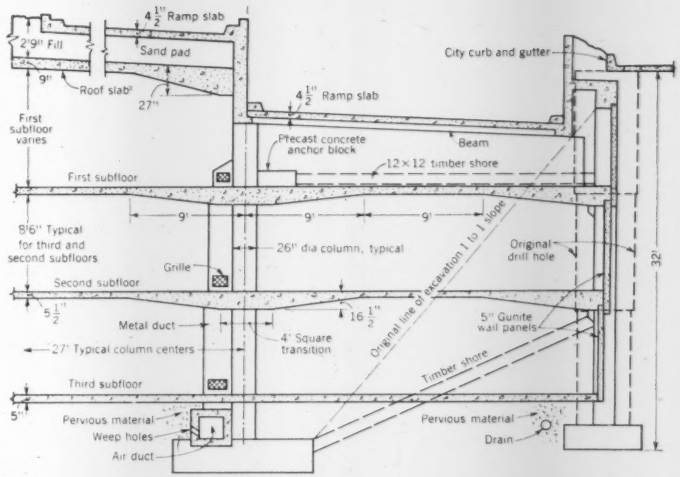
This unique garage incorporates the latest thinking in the structural design of concrete slabs. The floor system (Fig. 1) is a "haunched slab" supported by 26-in. round columns spaced 27 ft on centers both ways. On the under side, the floor slab slopes in four directions from a thickness of $16\frac{1}{2}$ in. at the columns to $5\frac{1}{2}$ in. at the one-third points of the spans. The roof slab, which supports a 2-ft 6-in. top-soil fill, is 2 ft 3 in. thick at the columns and tapers to 9 in. thick at the third points. The square tapered column capitals thus formed are more pleasing to the eye and more economical to construct than the conventional design of drop panels and column capitals. Another advantage is that the smoothness of the under side of the floor slab makes illumination more effective.

The flat slab was analyzed by the use of the plastic-model method, known as Presan analysis. The size and spacing of the reinforcing steel were determined by the actual moments imposed rather than by empirical moment coefficients or by rigid-frame analysis. This more balanced design resulted in material savings in steel and concrete. The inherent stiffness of the haunches contributed further to a reduction in the slab thickness.

Savings in the amount of reinforcing steel and in the cost of placement result from the use of the new type of deformed bars. Use of these bars also permitted increased working stresses and the elimination of practically all hooks, under the recommendations of the revised "Building Code Requirements for Reinforced Concrete" (ACI 318-15) of the American Concrete Institute.

Concrete for columns and floor slabs is designed for a compressive strength of 3,000 psi at the end of the usual 28-day period. A mix of 5.1 bags of cement per cu yd was made possible by using 0.4 lb of Type 4A Pozzolith per sack, and $1\frac{1}{2}$-in. coarse aggregate. To keep the slab thickness to a minimum in spite of increased loads, the concrete for the roof has a designed strength of 4,000 psi. This mix contains 6.1 bags of cement per cu yd, 0.4 lb of Type 4A Pozzolith per sack, and coarse aggregate with a maximum size of $1\frac{1}{2}$ in. The Gunite mix for exterior wall construction, which will be explained later, consists of one part cement and $4\frac{1}{2}$ parts of sand for the designed strength of 3,000 psi at 28 days. All the cylinders tested to date averaged from 400 to 800 psi above the designed strength. The 50,000 cu yd of transit-mixed concrete required for the structure is being placed by means of seven $\frac{1}{3}$-cu yd Whiteman motorized buggies.

Construction of this 2,000-car underground garage got off to a fast



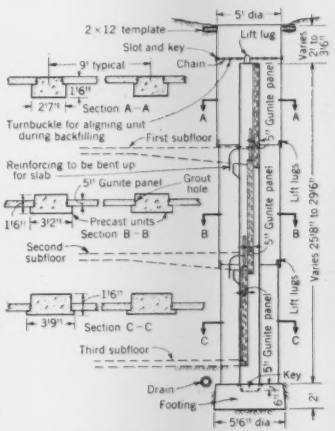
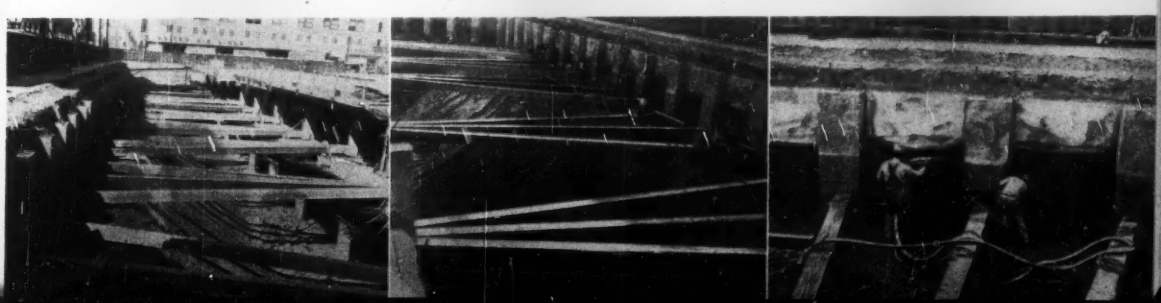
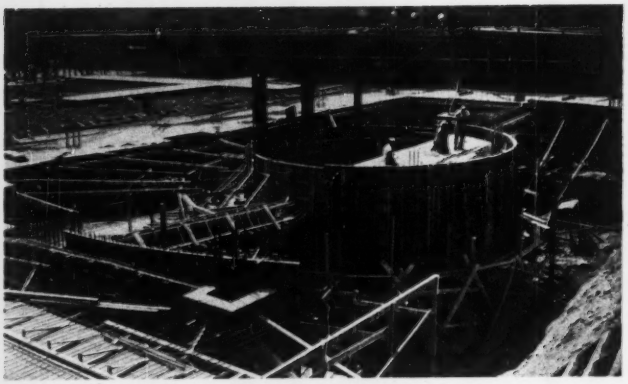


FIG. 1. TYPICAL sections through exterior side-wall columns and haunched floors (above) show column footings, ventilation and drainage ducts, and location of temporary shoring used while edges of site were being excavated and Gunite wall panels shot between exterior columns. Photos (below) show method of bracing by temporary timber shores while edges of site, on 1:1 slope, were excavated in 4-ft lifts from top down. Outside bays of garage were constructed last. This method prevented caving of surrounding streets.





FORMS and reinforcing for six circular superelevated ramps gave engineers and contractors a workout in elevation calculation and form design.

start when Mayor Fletcher Bowron and contractor Ford J. Twaits rode on top of a D-8 Caterpillar tractor in the ground-breaking ceremonies on February 1, 1951. The afternoon of the same day all the perfect trees and desirable plants were started on their way towards boxing and removal for storage until a future date, when they will be replanted in the restored park area after completion of the garage.

At the same time a D-8 Caterpillar began felling the trees that were too large or otherwise undesirable, and the construction of the City Park Garage was under way. While all the trees, plants, monuments, cannons and benches were being removed for storage, two power shovels started the 250,000-cu yd excavation job. Soon two $2^1/_2$-cu yd power shovels were loading $7^1/_2$-cu yd trucks. With a fleet of 45 trucks, an average of 600 loads were hauled per shift from 6 p.m. to 2 a.m. These hours for the 3 mile haul to Chavez Ravine, just out of the congested downtown area, were chosen for economy and to comply with police regulations and city ordinances.

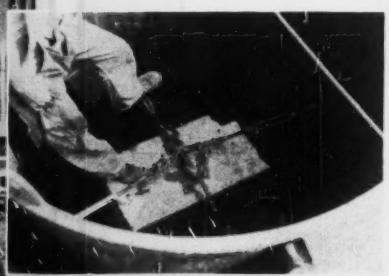
Clean washed fine brown sand, a mixture of sand and gravel with a small amount of clay, fine gray sand with a small amount of binding material, and a siltstone deposit known as Puente shale, were the four general types of soil found within the area of the project. The latter offered great resistance to removal by the $2^1/_2$-cu yd power shovels. Ground water, found at the 20-ft level in the north section of the project, was lowered below the footing level by periodic pumping from a deep sump. This 32-ft-deep "glory hole," located amid canyons of tall buildings, was excavated in two 16-ft cuts, the excavation being coordinated with the placing of the precast concrete columns around the perimeter of the building area.

Deep excavations in built-up areas generally are made by driving interlocking steel sheetpiles and bracing them against anchor blocks within the building area. As this method is noisy, costly, and often involves the contractor in damage suits because of the effects of earth vibrations in a built-up area, a new, practical and economical method was devised for the construction of the City Park Garage. On the basis of preliminary soil investigations and their many years of experience in constructing large buildings in the immediate vicinity, the contractors decided to place 30-ft precast concrete columns or exterior wall sections in the ground 9 ft on centers around the entire perimeter of the excavated area, and to leave the earth around them undisturbed on a 1:1 slope until the bulk of the structure was completed. These 18 × 36-in. columns weigh 9 tons each.

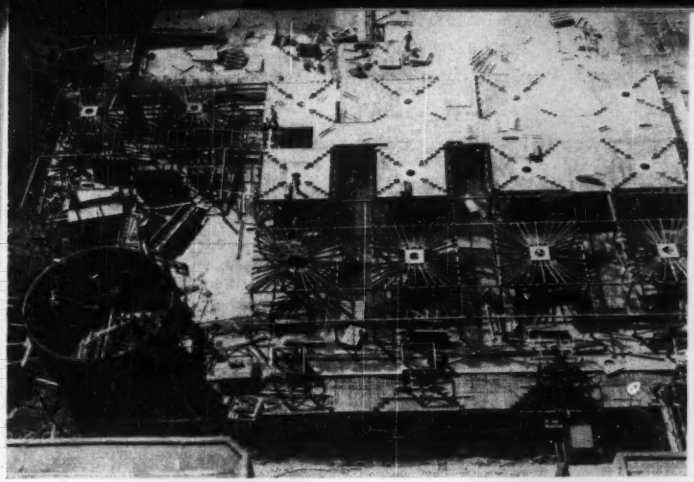
To ensure that the original ground would not be disturbed, the California Earth Boring machines first drilled holes 27 ft apart. After the wall sections had been accurately set and backfilled in these holes, the boring machines made a second circuit, drilling holes 9 ft from the first set. When the wall sections had been set in these holes, the boring machines made the third and last circuit boring holes 9 ft from those in the second circuit. These specially designed wall sections, with the undisturbed earth around them, support the edges of the excavated area during the construction period, and the concrete columns will become a permanent part of the exterior wall of the structure.

The 30-ft precast columns were set in 5-ft-dia holes. A three-piece telescoping steel casing was inserted in the hole to protect the workmen who belled out the bottom and placed the concrete footing, as shown in Fig. 1. After the 9-ton precast concrete units were set and aligned on the footing on the high early strength concrete (1,600 psi in 16 hours), a backfill of previous material was placed in the hole around each unit as the casing was withdrawn.

While the 208 precast sections were being placed, the general excavation continued in two 16-ft lifts, always leaving enough unexcavated material around the edges to form a 1:1 slope from the top of the wall sections down to the lowest level of the excavation. Thus there remained a bank of undisturbed soil on a safe slope to support the heavily traveled street areas



PRECAST CONCRETE columns, called wall sections, were set on 9-ft centers around outside of excavation. Columns, 30 ft long, were set by crane, carefully centered, concreted in, and backfilled with pervious material as casing for hole was withdrawn.



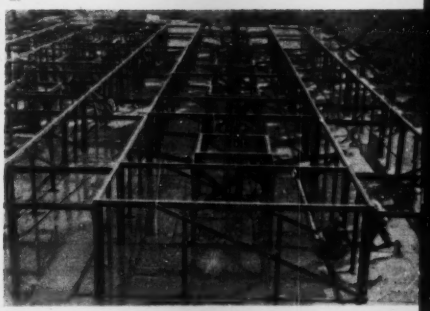
STEEL PAN FORMS for third-floor pour are seen in various stages of erection in view above.

outside the project while the construction of the interior part of the three-level garage proceeded. One outside bay was left unfinished on all four sides of the building.

After the main part of the building had been built, it was used as an anchor block to support 12 × 12-in. timber shores holding up the precast units while the 1:1 bank was removed. The precast columns were provided with shoulders on which 5-in.-thick Gunite wall panels were shot to support the undisturbed excavation bank. The excavation of the 1:1 berm will proceed downward to the first subfloor level in 4-ft benches. After the temporary 12 × 12 timber shores are placed between the precast wall sections and the columns of the interior part of the building at the first subfloor level, the excavation will proceed to the next floor level. Each 4-ft wall panel will be Gunited into place, until the lowest floor level is reached. This method of working from the top downward will eliminate the possibility of street cave-ins and consequent disruption of public utilities. The haunched floors of the center part of the garage will then be extended at each floor level across the

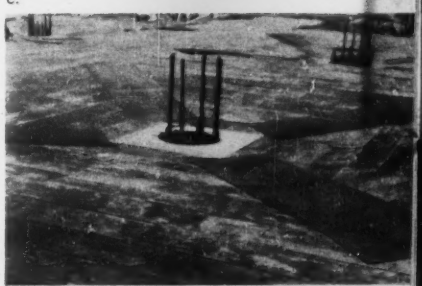
STEPS in construction of floor forms are shown in right column. Timber posts placed on concrete floor support stringers (*a*), and 2 × 8-in. joists 30 in. apart (*b*), on which are laid metal forms (*c*). Forms consist of 16-gage metal pressed sections 1 ft wide and 5 ft long. Transit-mixed concrete was distributed by Whiteman 9-cu ft motorized buggies (*d*). Forms and shores were removed after 7 days.

a.



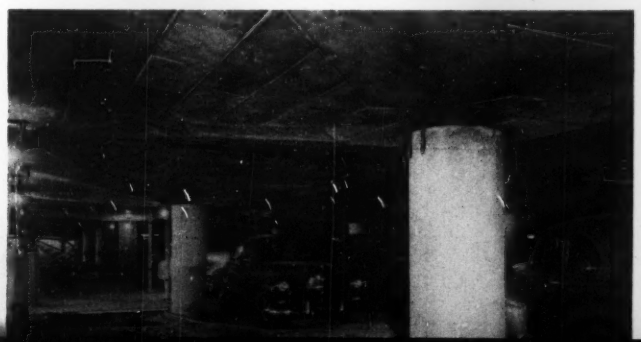
b.

c.



d.

PARTLY COMPLETED SECTION shows under finish of floor slab after removal of sheet-metal form panels. Workmen's cars were parked on third floor level six months after ground was broken.



CONCRETE FLOORS were poured from 6½-cu yd transit mixers, screeded to grade, and finished by self-powered mechanical troweling machines.

exterior bay to rest on the corbels in the precast exterior wall columns. There they will be attached by dowels to complete the structure.

Metal Pans Form Flat Floors

For economical slab-form construction, 16-gage metal slab forms 12 in. wide and 5 ft long are laid on joists spaced 30 in. apart. These 2 × 8-in. joists rest on 4 × 6-in. stringers, which are supported by 4 × 4-in. posts 6 ft on centers each way. Where the load on the forms was greater, because of the increased thickness of wet concrete at the tapered column capitals and roof, 4 × 8-in. stringers were supported on 4 × 8-in. posts. Since these metal forms can only form rectangular areas, a transition section was made, converting the 26-in.-dia column section into a section 4 ft square. Sheet-metal valley sections were used at the intersections of the tapered areas in the vicinity of the columns. All the slabs were reshored at the third points. The main shoring and metal pan deck were removed seven days after the concrete slab was placed. This made possible a quick turnover of shoring material, reduced costs, and speeded up the work.

Since the structure was designed to fit the contour of the area within the project limits, there was a 2½-in. fall in the floor slabs in each 27-ft bay from north to south, and a 4-in. fall in each bay from east to west. This plan reduced quantities of both excavation and materials. There are no level slabs within the main garage area, and construction is further complicated by warped slabs, curved walls, haunches, and curved beams.

ROOF ON WHICH FILL FOR PARK will be placed, is seen completed on distant, or south, portion of City Park Garage, in progress view as of November 1. Garage is scheduled for opening early in 1952.

This three - story underground structure was not designed primarily as a public shelter; however, it can protect more than 50,000 persons in the event of a disaster. The 2-ft 6-in. earth cover, the complete ventilating system, and the stand-by power plant, add to its ability to protect human life. Government agencies already have declared reinforced concrete garages both above and below ground in many cities to be suitable as public shelters for civilian defense.

Culmination of Long Effort

The thought of parking automobiles under Pershing Square entered the minds of downtown business men more than twenty years ago, but it was not until after the votes in the April 1947 election were counted that the project was launched. The charter amendment, passed by a two-to-one vote, gave the city the authority to lease the subsurface of the 350 × 600-ft downtown park. After a diligent job of promotional work on the part of the Downtown Business Men's Association, interest in the project was shown by the Ford J. Twaits Co., Morrison-Knudsen Co., and Stiles Clements. Subsequently a new corporation was formed, known as City Park Garage, Inc., with Ford J. Twaits as president.

The first mortgage for this $5,000,000 undertaking is held by the Equitable Life Assurance Society. Second debenture mortgage bonds sold to local business interests and common stock purchased by the City Park Garage, Inc., completed the necessary financing. No federal, state, or city money will be used to defer any of the expenses of investigation, planning, design, or construction of this project. When completed, the City Park Garage, Inc., will hold only a 50-year lease on its subsurface facilities, and will pay a minimum rental of $25,000 per year to the city. At the end of 50 years the present lease will expire and the city will have full control over the park subsurface to operate it through its departments or lease it to another operator.

City Park Garage was designed by Stiles Clements, Associated Architects and Engineers, with Murray Erick as consulting engineer. The joint-venture contractors are Ford J. Twaits Company, Morrison-Knudsen Company, Inc., and T-S Construction Engineers, Inc.

Shortage of materials jeopardizes defense power program

R. F. BROWER

Consultant, Defense Electric Power Administration, Washington, D.C.

THE ELECTRIC power outlook for 1952 is more serious than it was at any time during World War II. This situation is not the result of a failure of the utilities to plan ahead, since the planning has been done, but such plans are useless unless sufficient materials are made available to carry the program through on schedule. To hope that the program can be carried out as originally planned is wishful thinking.

Some of the delays that have already occurred have unquestionably been the result of the growing pains of the Controlled Materials Plan. However, even with a perfect system of allocation, the cold fact is that there is not enough steel, copper, aluminum and other materials to satisfy the insatiable appetites of the military, the atomic energy program, the petroleum, steel and electric power industries, and the needs of supporting industries—all on top of a rather healthy civilian economy.

Our utility systems entered the World War II era with a capacity of $42^1/_2$ million kw and a load of $34^1/_2$ million kw, a reserve of 8 million kw, or 23 percent of load. This reserve, coupled with wartime brownouts, lengthened working hours, and minimum production of civilian goods, resulted in relatively minor interruption in war production due to lack of electric power.

Rapid Load Rise After Korea

Shortage of materials and equipment during the war and the long time needed to construct new electric capacity (2 or 3 years for steam and 5 or 6 years for large hydro developments) caused electric capacity to fall behind. But by 1949 there was again a relatively good balance between capacity and load, the reserve being about 12 percent of load. Early in 1950, just before Korea, the utility systems anticipated that power requirements would continue to increase at a normal rate and made plans to install about 17 million kw in the three-year period 1950–1952.

Shortly after Korea, however, power requirements began to rise rapidly, with the result that by December 1950 the actual load was 3 million kw above that estimated a few months before, an increase of $13^3/_4$ percent over the preceding year. Plans were therefore revised to install 27 million kw in the three-year period 1951–1953. This planning for the mobilization period was imaginative and courageous.

In some sections of the country, notably the Northwest and the Southeast, the impact of the mobilization program has been more pronounced than in other areas. In the Southeast large unforeseen increases have already occurred, due largely to the requirements of the Atomic Energy Commission. However, provided the construction program can be kept on schedule, this area should be self-sufficient by the end of 1952 except under the most extreme drought conditions.

In the Pacific Northwest, most of the power is from hydro plants, which take a long time to construct, and for that reason, we are touching bottom there. Because of the large increase in industrial demand, it became necessary to curtail loads in the Northwest about September 1, 1951. The cut came in aluminum, one of the three vital controlled materials. Fortunately rains came and full aluminum production was restored in a short time. Should water conditions be above normal throughout the winter, curtailment of defense production will be slight, but extreme low water would bring about a critical situation requiring drastic reductions in the production of critical materials.

The Defense Electric Power Administration has issued an order calling for curtailments in the following order: A cut in interruptible contracts for production of aluminum; an area-wide brownout; a 10-percent reduction to all industrial customers. If further relief is needed, aluminum production will be still further cut and another 10-percent reduction will be applied to other industrial customers.

Although several large hydro projects are under construction in the Pacific Northwest, it is improbable that a reasonable balance between capacity and load under adverse water conditions can be restored for three or four years. By that time, also, new steam plants can be put in operation, provided that the necessary materials can be obtained.

Lack of materials is already seriously jeopardizing the power program and unless this situation can be corrected at an early date, the critical power situation in the Pacific Northwest and in the Southeast is likely to spread to other sections of the country. More than half of the structural steel allotted to the Defense Electric Power Administration in the third quarter of 1951 did not materialize because the orders were not accepted by the mills. In the same period labor difficulties and inability to obtain other materials such as copper, further cut into the utility program. These third-quarter difficulties have already caused serious delays in installations totaling almost $1^1/_4$ million kw.

Steel Shortage Affects Future Work

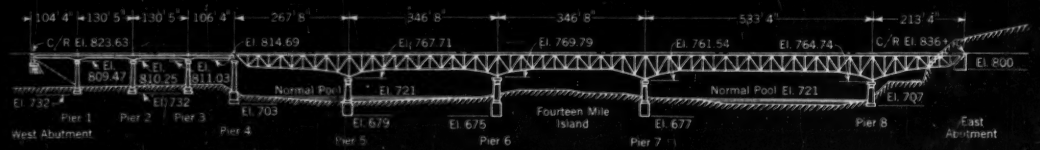
The effects of the loss in structural steel will not be fully apparent until the winter of 1952, when, it is estimated, 1,400,000 kw of programmed additions will have been lost. Should these cuts continue for another year, it appears that by the end of 1953 at least 4 million kw will have been lost.

The dearth of materials can best be illustrated by an analysis of the requirements for steel all over the country in the first quarter of 1952. The estimates of requirements received by the Defense Production Administration from all claimant agencies totaled 165 percent of the amount of steel available. The military and the AEC take the first cut, a very substantial part of the total. The remainder will be about 60 percent of all other requirements.

It is evident that one of the major functions of the Defense Electric Power Administration is the obtaining of materials. Our greatest concern is that sufficient materials may be forthcoming so that in the mobilization program, electric power will not be "too little and too late."

(This article is an abstract of Mr. Brower's address before the Power Luncheon, sponsored by the Power Division, at ASCE's Annual Convention in New York.)

Bridge substructures built to fit site conditions



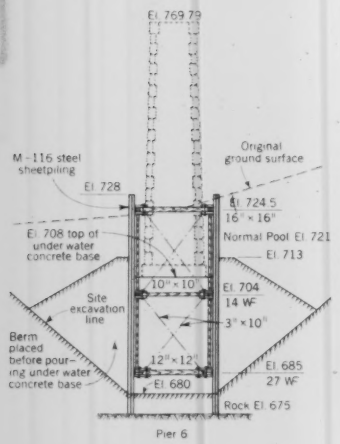
THE Western Extension of the Pennsylvania Turnpike extends 67 miles from Irwin, near Pittsburgh, to the Ohio border. With its dedication on November 26, 1951, the Pennsylvania Turnpike is open for traffic from King of Prussia, near Philadelphia, to the Ohio border, a total distance of 327 miles.

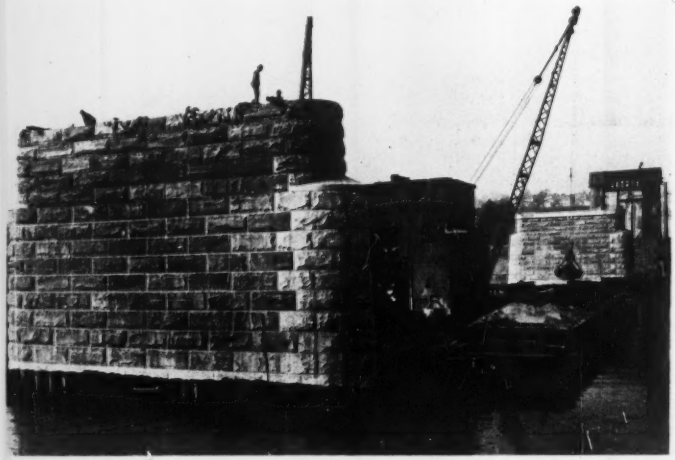
Like the original Turnpike and the recently completed Eastern Extension, the Western Extension is a limited-access toll highway. This means that numerous bridges are required, not only to cross streams but also to eliminate grade crossings. The two major bridges on the Western Extension are located where the four-lane superhighway crosses the Allegheny River near Oakmont, Pa., and the Beaver River near Homewood, Pa.

The Contracting Division of Dravo Corporation, Pittsburgh, was awarded the contracts by the Pennsylvania Turnpike Commission to construct the substructures of both bridges on its low bids of $914,818 for the Allegheny crossing, and $597,489.50 for the Beaver crossing. Both substructures were recently completed.

Because of different topographical conditions at the two locations, these bridges are totally dissimilar in design. The 2,179-ft-long Allegheny River crossing (Figs. 1 and 2) is in a rather wide valley with rock approximately 45 ft below normal river elevation. It is the second longest bridge on the entire turnpike. The 1,540-ft-long Beaver River crossing (Figs. 3 and 4) is in a narrow valley with rock near the surface on the

FIG. 2. PIER 6 is typical of three main river piers of Allegheny River Bridge, and construction methods on all three were similar. Single-skin sheetpile cofferdams were excavated in the wet and underwater base was poured before dewatering. In photo, Dravo mixer boat is shown working on a main river pier. These piers are faced with granite from 10 ft below normal pool elevation to 8 ft above. Upstream noses up to starling course are also granite faced. Remaining parts are faced with limestone.





on Pennsylvania Turnpike's Western Extension

CHARLES W. GRANACHER, M. ASCE, Engineer, Dravo Corporation, Pittsburgh, Pa.

FIG. 1. ALLEGHENY RIVER BRIDGE, 2,179 ft long, rests on eight piers and two abutments, constructed by various methods depending on site conditions.

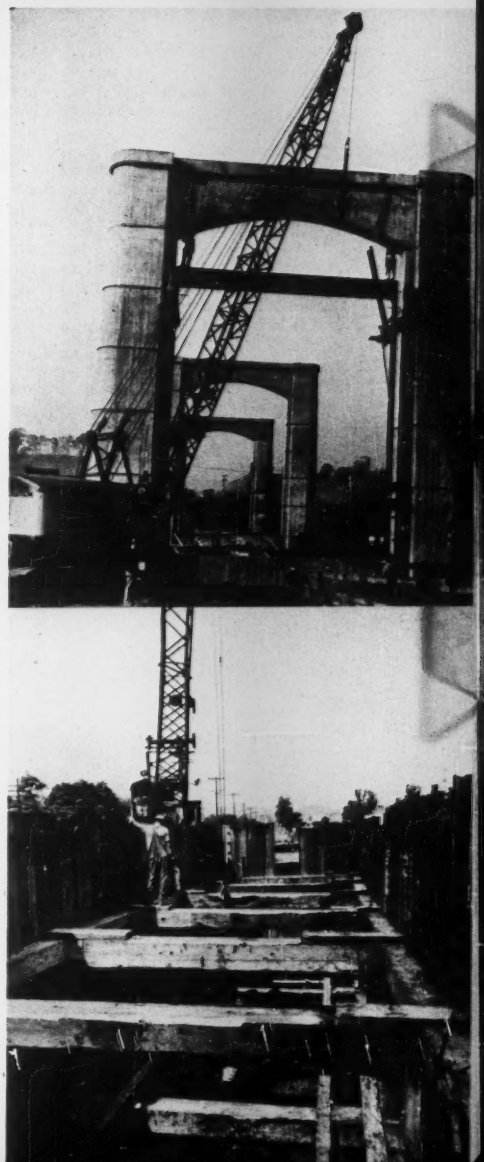
valley sides and about 65 ft below normal river elevation in the stream bed.

Construction of Allegheny River Piers

The substructure of the Allegheny Bridge consists of eight piers and two abutments (Fig. 1). Piers 1, 2 and 3 are supported on spread footings at El. 732 on compact sand and gravel. Piers 1 and 3 were constructed in open excavations while Pier 2 was constructed in a shallow cofferdam. This cofferdam was required because the pier was located in the middle of State Highway 28, and the temporary detour was too close to the pier to permit sloping of the excavation.

Pier 4 is supported on a spread footing at El. 703 on compact sand and gravel. The pier site was excavated to El. 708, and a single-skin sheetpile cofferdam 20 ft wide and 63 ft long was constructed with the top of the piles at El. 728. Then the area inside the cofferdam was excavated in the wet to El. 703 and the area outside the cofferdam was bermed to El. 718, after which an underwater concrete base was poured to El. 713. When the base had hardened, the cofferdam was pumped out and the rest of the pier was built in the dry.

Piers 5, 6 and 7, the main river piers, are founded on shale rock at Els. 679, 675 and 677 respectively. Pier 5 is located in the middle of the back channel of the river, while piers 6 and 7 are near the two shore lines of a large island that lies in the river at the bridge site. The construction methods used to build these three piers were similar. (See Fig. 2) First the site was excavated in the wet to within 5 ft of rock by a derrick boat with a $3\frac{1}{2}$-cu yd clamshell bucket. Next, the complete coffer-



LAND PIERS on west side of Allegheny River are supported on spread footings on compact sand and gravel. In top view, part of arch form supports on near pier are being removed. Piers 1 and 3 were constructed in open excavations but Pier 2 was built in shallow cofferdam (below) since temporary highway detour was too close to permit sloping of excavation.

dam bracing sets, which had been previously fabricated as a unit on a barge, were set in place and used as a template to set and drive the 20-ft-wide and 75-ft-long single-skin sheetpile cofferdam. The top of the sheetpiles was at El. 728.

After the piling was driven to rock, the bracing sets were tied to the piling, and the area inside the cofferdam was excavated in the wet to rock by clamshell. To insure a satisfactory bottom, the entire area inside the cofferdam was cleaned off with an air lift to remove the small amount of material left by the clamshell. This last operation was checked by a diver, and when completed left a bottom of bare rock. After berming outside the cofferdam to El. 713, an underwater concrete base was poured to El. 708. The depths of the bases for piers 5, 6, and 7 were, respectively, 29, 33 and 31 ft, and the volumes of concrete were 1,670, 1,904 and 1,788 cu yd. Each base was made in one continuous pour. The bracing sets below El. 708 were left in place and embedded in the base pour. After the concrete had hardened, the cofferdam was pumped out and the rest of the pier was built in the dry.

Pier 8 is located at the bottom of a steep bank, with the main-line tracks of the Pennsylvania Railroad running in a notch cut in this bank. The pier is supported on shale rock at El. 707. To construct this pier, a cellular cofferdam was built on the river side of the pier, and a single row of sheetpiling, braced to the cells, was placed on the land side. This method was needed to hold the hillside in place while its toe was removed to build the pier. The cofferdam was unwatered and the pier built in the dry. The west abutment is supported on concrete step-taper piles driven after the approach fill was placed.

Because the east abutment is located in a deep cut at the top of the valley side, its construction was sublet to the Hunkin-Conkey Construction Co., which had the grading contract for the east approach to the bridge.

Pier 4 is faced with limestone from El. 732 to 755. Piers 5 to 8, inclusive, are faced with granite from El. 711 to 729 and also on their upstream noses up to the starling course. The remaining parts of these piers are faced with limestone.

Concrete for all the bridge piers was mixed in a single-drum, 2-cu yd mixer boat. Cement and aggregates were delivered by barge. The concrete was handled from the mixer boat directly to the river piers by derrick boats and was trucked from the mixer boat to the land piers, where it was handled by crawler cranes.

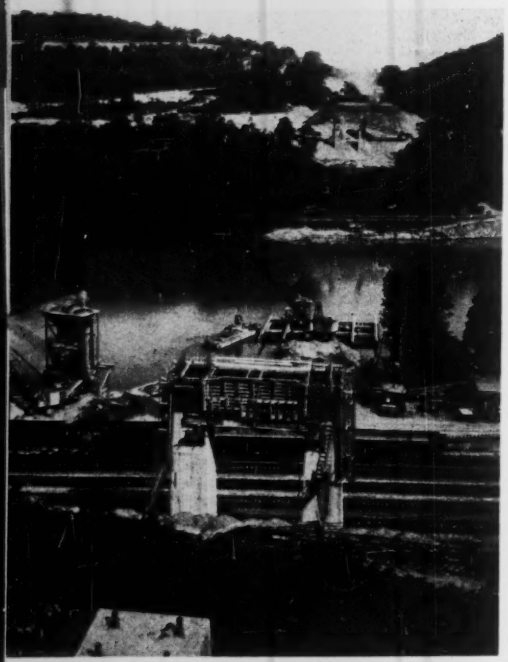
Approximate quantities of the principal items are as follows:

Excavation . . .	20,000 cu yd
Concrete	10,000 cu yd
Stone-faced ashlar masonry . . .	6,500 cu yd
Reinforcing steel .	135,000 lb
Fabricated structural steel . . .	130,000 lb

Steel Bearing Piles for Beaver River Bridge

On the Beaver River bridge project, both abutments are supported on steel bearing piles driven after the approach fills were placed (Fig. 3).

Piers 1, 2, 5 and 6 are founded on rock at varying elevations and were constructed in open excavations. Because these four piers are located on steep hillsides, it was necessary to build an access road to each pier site. Crawler cranes handled the excavation, concrete and form work. Concrete was trucked to the piers.



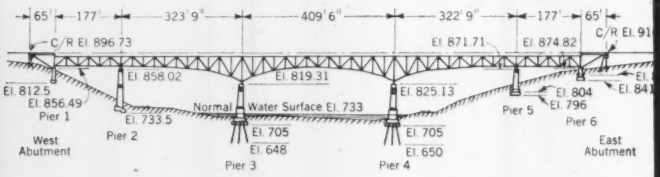


FIG. 3. PIER CONSTRUCTION for Beaver River Bridge was complicated by steep slopes leading down to river, which required building of access roads to land piers. Earth ramp was built to each river pier. Photo, looking from west abutment toward east bank, shows concrete mixing plant on bank at left. Concrete for east bank and river pier construction was transported by cable-operated ferry, seen delivering buckets to crawler crane at Pier 3.

Piers 3 and 4, the main river piers (Fig. 4), are located in the river near the two shore lines. Each is supported on fifteen 30-in.-dia by $^1/_2$-in.-thick steel pipe caissons. Similar construction methods were used on both piers. Crawler cranes operating on an earth ramp built out from the shore line to the pier site were used to build both of these piers. Each pier was constructed inside a single-skin cofferdam about 33 ft wide by 76 ft long, with two sets of internal bracing. The top of the sheets was at El. 736. The area inside the cofferdam was excavated to El. 705 in the wet. Then the 76-ft-long pipes, each fitted with a cast-steel driving shoe, were set in position and driven to rock using a 10B3 McKiernan & Terry pile hammer.

These pipes were of such length that the tops extended above the surface of the water after they had been driven to rock. Material inside the pipes was removed by an air lift. A high-pressure water jet was also used to loosen this material. When all the material that could be excavated by this method was removed, the pipes were pumped out and the remainder to rock was excavated by hand. Then 28-in.-dia sockets were drilled in the rock to a depth of at least 7 ft below the bottom of the driving shoes on the pipes. This item was performed by the Pennsylvania Drilling Co. under a subcontract. The final steps of completing the pipe caissons consisted of setting a 14-in. × 193-lb H-beam core and filling the pipes with concrete to above the bottom of the general pier excavation.

A 6-ft-thick underwater concrete base was poured inside the cofferdam, and after it had hardened, the cofferdam was pumped out. Then the pipes extending above the top of this base pour were burned off, and the remainder of the pier was constructed in the dry.

Land Mixing Plant Used

As the Beaver River is not navigable at this point, a land mixing plant had to be used. A single-drum mixing plant of 2-cu yd capacity was built on the western bank of the river. Cement was blown from railroad cars to the plant, and aggregates were transferred from cars or storage piles by a crawler crane. Concrete for the piers and abutment on the west side of the river was trucked from the mixer plant. Concrete for the two river piers was transported from the plant to the pier locations in buckets on a cable-operated pontoon ferry, and handled to the piers by crawler cranes. Concrete for the piers and abutment on the east side of the river was ferried across the river and transferred to trucks, which hauled it to the pier locations.

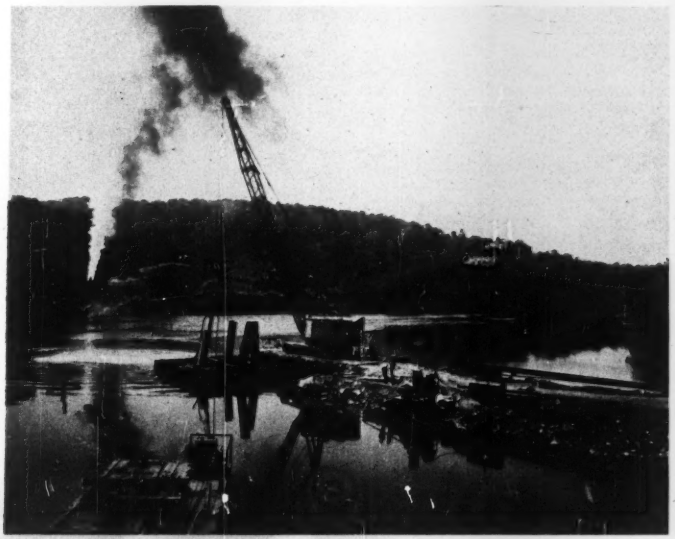
Some approximate quantities are:

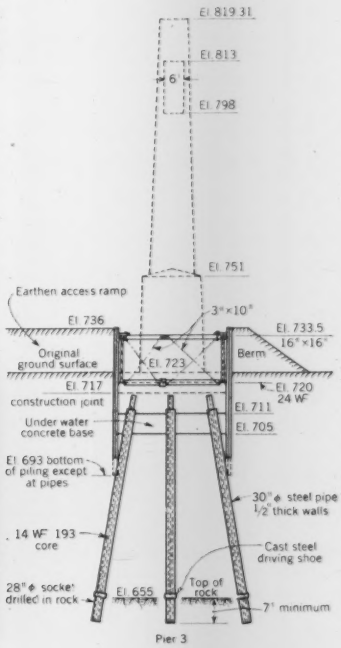
Excavation . . .	7,500 cu yd
Fill (west abutment)	13,000 cu yd
Concrete	9,000 cu yd
Pipe caissons . .	1,600 lin ft
Reinforcing steel .	320,000 lb

Personnel on the project for the Pennsylvania Turnpike Commission included the resident engineer for the Allegheny River Bridge, M. L. Duncan, and for the Beaver River Bridge, Arthur Forrester. B. H. Parker was job superintendent for Dravo on the Allegheny River Bridge, and R. F. Hansen and W. R. Switzer were job superintendents at Beaver River.

The Allegheny River Bridge was designed by Modjeski and Masters, Engineers, Harrisburg, Pa., and the Beaver River Bridge by George S. Richardson, M. ASCE, Consulting Engineer, Pittsburgh, Pa.

FIG. 4. CROSS SECTION of main river pier (Pier 3) of Beaver River Bridge appears at right. Piers 3 and 4 are nearly alike; each is supported on fifteen 30-in. pipe caissons. In photo below, water jet and air lift are being used to remove material from one of these caissons on Pier 3. Earth ramp was built to avoid use of floating equipment (except for cable-operated barge transporting concrete) as river is not navigable at bridge site.





Call a moratorium on federal water resources projects

A Statement by the EJC Panel on Water Policy

ENGINEERS Joint Council, on October 19, addressed the communication reproduced on the facing page to all members of the Congress of the United States, presenting its conclusion as to steps that should be taken to insure the adoption of a sound national water policy.

Before a session of the Sanitary Engineering Division at the Annual Convention of the American Society of Civil Engineers, the principles advocated by EJC were summarized in an address by ASCE Past-President W. W. Horner, the Panel Chairman, and the report of the President's Commission was discussed by a member of the Commission, Samuel B. Morris, M. ASCE. These presentations and the ensuing discussion indicated a wide divergence between the findings of the two groups as to the concept of what constitutes a sound water policy, but also complete agreement as to the urgent need for action by Congress to prevent further wasteful expenditures.

In terms of basic principles, the views of the EJC Panel and those of the President's Commission are far apart and in some respects diammetrically opposed. EJC states that:

> Control of the waters of the United States is in the national interest but not necessarily a function of the Federal Government . . . .
>
> So far as practicable, basin-wide planning free from Federal domination should be the objective . . . .
>
> Water resources development should whenever feasible be by local enterprise, governmental or private.

The PWRPC suggests that an entirely new system of government be set up throughout the country. This government would consist of so-called River Basin Commissions which would be entirely independent of the local and state governments and would take over much of the control now exercised by these governments. These commissions would be controlled by commissioners and by a chairman, appointed by the President, who would be in no way responsible to the citizens of the area.

EJC visualizes economic justification as involving an appraisal in monetary terms of tangible net benefits—including negative benefits or detriments—and a finding that benefits appreciably exceed the cost. Citizens who pay federal taxes are considered entitled to an assurance of a substantial increase in the national wealth as partial compensation in cases where they participate in resources development.

The PWRPC report recommends project appraisal accounting but states:

> The Government has come to be recognized as an agency for social and economic action which need not follow the rules of the private capital market in order to obtain the necessary capital, or make investment decisions.
>
> Many projects will have their major effect on the broad development of our social economy. It will therefore be contrary to the public interest to place principal reliance in project analysis on primary benefits . . . .

In regard to final decisions as to undertaking projects:

> Judgment becomes a matter of collective common sense which should be based on dollars-and-cents estimates, but must transcend them in order to give due weight to intangibles.

Both groups believe that local and regional beneficiaries should pay a portion of the cost related to such benefits, but EJC approaches this from the direction of local or regional initiative in basin planning, while the PWRPC treats it as an assessment levied by the Federal Basin Commissions, but to be collected by states or local agencies.

There is a wide difference in the policies proposed as to hydroelectric power. EJC favors local enterprise, public or private, while PWRPC states:

> Future licenses for non-federal water power developments should be issued only with the joint consent of Federal Agencies responsible for power in basin programs.

Similar differences might be cited in other phases of water resources development, indicating the concentration of EJC thinking in the direction of sound economics and that of the PWRPC on so-called social values. For example from the PWRPC report comes the following:

> Increasingly, as the Government has undertaken large investments for public purposes rather than simply to serve private purposes not fulfilled by private capital, the principle of full reimbursement has ceased to be useful or necessary.

Both viewpoints must be given consideration by the Congress when and if any legislation defining water policy is written. No such legislation is before Congress at the present time. It is understood that suggested legislation has been prepared by the PWRPC and that it is now being studied and probably will be modified by a federal interdepartmental group under the leadership of the Bureau of the Budget. There is a possibility that no bills will be placed before Congress for some time to come and that the present wasteful authorization of questionable projects may continue. The urgency of the time element is a matter on which the two groups are in full accord.

Both reports agree that immediate action is needed to avoid continued wasteful expenditures. It is not surprising that the two reports are in close agreement in their analysis of present procedure and practices for the authorization of, or appropriation for, water projects. No intelligent citizen who studies the record can fail to realize that present practices involve the wasteful expenditure of tremendous sums of the federal taxpayers' money. The EJC Panel states:

> The authorization act (of 1950) provides for the construction of works whose estimated total cost will be more than 1.8 billion dollars. No one, and least of all the President, was under the impression that this authorization bill is sound with respect to the wisest expenditure of public money.

In addition, many of the authorizations provided in the Act were for undertakings which realistic diagnosis and measurement would disclose as neither desirable nor warranted. The last two decades are characterized by a surprising degradation in the application of any criteria to water resources development. It is true that all the benefits to be derived from national undertakings are not easily convertible into quantitative terms, but it is equally true that the application of no criteria must result in chaotic and indiscriminate expenditures, in which the good and the bad projects are indistinguishable.

It is recommended that, in general, until a pertinent uniform national policy has been decided upon and made effective, there be no further authorizations and no appropriations for Federal water developments except further appropriations for those projects as to which irrevocable commitments have been made to the extent of at least one-quarter of the up-to-date estimates of cost.

The PWRPC states:

There is today no single, uniform Federal policy governing comprehensive development of water and land resources.

There is a time for action based on sober consideration of objectives and methods. Continuation of present policies, or lack of them, will mean a continuing waste of money and effort in the pursuit of conflicting goals.

In summary, there is agreement that project authorization under present procedures is resulting in excessive expenditure of the taxpayers' money for water resources projects not chosen in terms of proper priority with respect to national values, and in the case of many, with their economic justification not adequately shown.

There is agreement also that authorization of additional new projects, in the absence of a sound and unified policy, is not in the public interest. There should be a moratorium on new projects. There is additional agreement on the urgent need for an adequate statement by the Congress of a sound over-all national water policy.

The suggestion by EJC that Congress create a joint committee to develop and recommend such policy legislation appears to be a necessary initial step; it deserves strong support by all members of the engineering profession.

(Copies of the three-volume report of the President's Water Resources Policy Commission are available from the Superintendent of Documents, Washington, D.C. Copies of EJC's report on "Principles of a Sound National Water Policy," and its "Critique of the Report of the President's Water Resources Policy Commission," which were mailed to every member of Congress with the letter reproduced at the right, are available at EJC Headquarters, 33 West 39th Street, New York 18, N.Y.)

October 19, 1951

Dear....(individually addressed to each member of Congress)

In June 1950 Engineers Joint Council presented to the President's temporary Water Resources Policy Commission a "Statement of Desirable Policy With Respect to the Conservation, Development and Use of the National Water Resources."

Engineers Joint Council serves as the agency for cooperative action on the part of the five major professional engineering societies of the country, with a combined membership of more than 100,000. Beginning in 1947, EJC has been studying the possibilities of bringing about Congressional adoption of a coordinated and uniformly applicable national water policy and the principles which should underlie such policy.

Subsequently, in December 1949, the President's temporary Water Resources Policy Commission was designated, whereupon Engineers Joint Council prepared and in June 1950 presented to that Commission a "Statement of Desirable Policy With Respect to the Conservation, Development and Use of the National Water Resources."

The report of the President's Commission was issued in December 1950 and has been reviewed by the Water Policy Panel of Engineers Joint Council. The Panel noted one finding of the President's Commission with which it is in full accord, namely:

> "There is today no single, uniform Federal policy governing comprehensive development of water and land resources."
>
> "This is a time for action based on sober consideration of objectives and methods. Continuation of present policies, or lack of them, will mean a continuing waste of money and effort in the pursuit of conflicting goals."

THE PANEL FINDS THAT THE REPORT OF THE PRESIDENT'S COMMISSION CONTAINS MANY RECOMMENDATIONS OF VALUE. ITS UNDERLYING PHILOSOPHY IN MANY RESPECTS, HOWEVER, VIOLATES PRINCIPLES WHICH THE PANEL CONSIDERS FUNDAMENTAL TO SOUND POLICY. IN OUR OPINION THE OVERALL PROPOSALS OF THAT COMMISSION'S REPORT CANNOT CONSTITUTE "A WATER POLICY FOR THE AMERICAN PEOPLE" UNLESS THE AMERICAN PEOPLE ARE PREPARED TO TRANSFER ALL THEIR RESPONSIBILITIES TO A BENEVOLENT CENTRAL GOVERNMENT.

We understand that the 82nd Congress may be expected to receive and consider proposals for legislation in implementation of the recommendations of the President's Commission, either proposals as made to the President by that Commission itself or modifying proposals submitted by the pertinent Federal agencies in cooperation with the Bureau of the Budget.

In prospect of such consideration, we are sending you herewith an appraisal of the report of that Commission as prepared by the EJC Water Policy Panel. Since this appraisal to a great extent constitutes a criticism, we have felt obligated to place in your hands at the same time our ideas of the principles which should be embodied in a sound water policy. These ideas are contained in the document entitled "Principles of a Sound National Water Policy", consisting of a general statement of fundamental principles and of nine sub-sections, each of the latter prepared by a separate Task Committee. This document has been the voluntary work of a group of seventy-five experts selected by our Water Panel because of individual long experience in water resources and water conservation, and also with a view to obtaining adequate geographical distribution of experience.

This material is transmitted to you at this time for your use when and as proposals for legislation, intended to modify or clarify over-all national water policy, come before your Congressional Committees. Engineers Joint Council understands that Congress has not as yet set up any specific machinery for considering and perfecting such legislation. In the absence of such specific action, we can imagine the various proposals intended to clarify and modify national water policy may be considered by separate committees of both houses of Congress. We are extremely doubtful that an adequate and unified water policy could result from such a course of action.

TO SECURE COORDINATION OF WATER RESOURCES LEGISLATION IN ALL FIELDS OF ENDEAVOR, IT IS THE OPINION OF COUNCIL THAT THERE WOULD BE NEEDED, AND THAT CONGRESS SHOULD SET UP, EITHER A SPECIAL JOINT COMMITTEE OR A COMMISSION WHICH SHOULD BE CHARGED WITH THE DUTY OF COORDINATING ALL LEGISLATIVE PROPOSALS AND OF WELDING THEM INTO THE EQUIVALENT OF AN OVER-ALL STATEMENT OF NATIONAL POLICY. WE STRONGLY RECOMMEND THAT YOU GIVE SERIOUS CONSIDERATION TO THE PROPRIETY OF SUCH AN ACTION.

Very truly yours,

James M. Todd

President
ENGINEERS JOINT COUNCIL

Enclosures

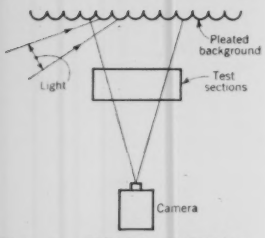


FIG. 1. SPECIAL LIGHTING arrangement has been developed for glycerine test to show streamlines with maximum clearness.

Photoviscosity of glycerine proves useful tool

W. W. HAGERTY, Professor of Engineering Mechanics

R. A. YAGLE, Research Engineer

Engineering Research Institute, University of Michigan, Ann Arbor, Mich.

ABOUT FOUR years ago, a study of certain transition problems in fluid mechanics was being made at the University of Michigan. The method used to observe the flow was to suspend particles of foreign material, such as lint or aluminum flakes, in the liquid. In the course of investigating a range of viscosities, it happened that glycerine was used as one of the test fluids. During these tests it was observed that the streamlines were visible without using any special lighting arrangement. This phenomenon was described by Dr. Hagerty in the *Journal of Applied Mechanics* (Vol. 17, No. 1, p. 54–58).

Since that time, surveys of the literature and discussions with many people in various fields, such as optics and chemistry, have not thrown any additional light on the nature of this property of glycerine. In the hope of encouraging further discussion and use of this phenomenon, it seems desirable to report on such physical features as have been observed.

The property of glycerine that makes the streamlines visible has been called photoviscosity. The name was suggested by the similarity of the phenomenon to photoelasticity. The material is in a state of shear. The planes of equal shear become visible when viewed along a path tangent to the shear planes. The general appearance is much the same as when two transparent, immiscible liquids of different optical density are mixed.

One of the most remarkable features of the lines is the manner in which they persist when the flow or motion is suddenly stopped. The residual pattern remains visible in the stationary liquid for as long as 30 to

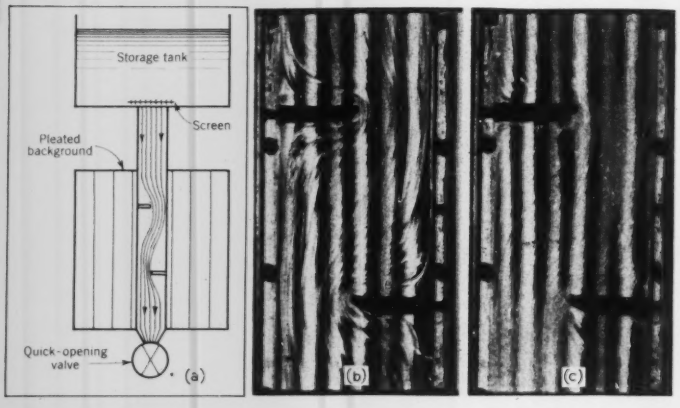


FIG. 2. RECTANGULAR CHANNEL with baffles for glycerine flow test (at left) arranged as in (*a*), yields streamlines shown in (*b*) and (*c*) for Reynolds numbers of approximately 1 and 6 respectively.

FIG. 4. ANNULUS (opposite page) between inner rotating cylinder and outer stationary cylinder, for glycerine flow test arranged as in (*a*), yields streamlines shown in (*b*) for random initial disturbances in development of secondary motion; in (*c*) for early stage in development of secondary motion; in (*d*) for intermediate stage; and in (*e*) for advanced stage of secondary motion.

in flow studies

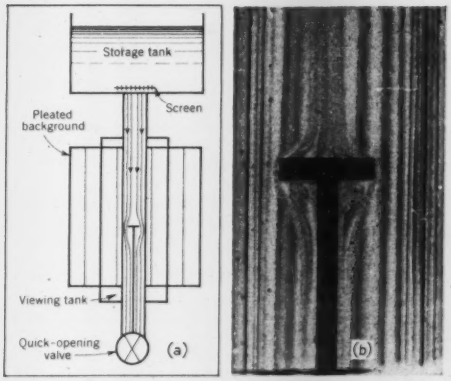


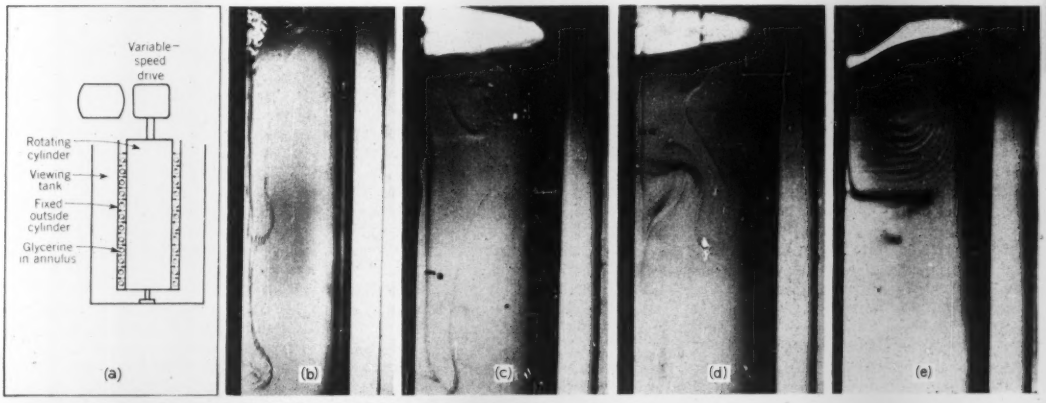
FIG. 3. DISK MOUNTED in round pipe for glycerine flow test arranged as in (*a*), yields streamlines shown in (*b*), where Reynolds number is approximately 10.

45 min. After about 10 or 15 min the lines diffuse in a noticeable manner and become "fuzzy" in appearance. Nevertheless the residual pattern may be studied or photographed in a fairly leisurely manner.

Another characteristic of the lines is that when motion or shearing of the same portion of the liquid is continued for a period of time the lines gradually fade, becoming less distinct as time goes on. The length of time required for the lines to fade out depends on the rate of shear. That is, for low rates of shear the lines are visible for longer periods of time than for higher rates. The lines also become less distinct when the glycerine is recirculated continuously through the system. In general it may be said that best results are obtained by passing the glycerine through the system just once. The streamlines are much less noticeable the second time, and so on.

Once the glycerine has been circulated long enough so that the lines no longer appear with sufficient clarity to be useful, it should be set aside for a few hours. After such a period it may be used again, and the lines will reappear in their original clarity. The effect is similar to that of thixotropic materials which exhibit a change in viscosity when worked, but recover their original viscosity when undisturbed. Chemists state that glycerine exhibits no such thixotropic behavior with regard to viscosity.

Numerous other liquids, among them mineral oil and castor oil, have been tested for this photoviscous effect, but so far no other liquid has been found in which the streamlines became visible without special light-



ing arrangements. For this reason it is believed that the phenomenon is somewhat different in nature from the streaming birefringence exhibited by Canadian balsam, for example, in which lines can be made visible in a polarized-light arrangement. In the case of glycerine, no arrangement of lights and polaroid screens could be found to produce any improvement in the intensity of the flow lines, nor did the use of the Schlieren method prove helpful.

Present Technique and Apparatus

When the first photographs were taken in this study, the technique used was to provide a diffused, indirect light so the streamlines could be viewed against a dull white background. In an effort to improve the visibility, the lighting was improved so as to be as uniform as possible over the entire background surface. When such lighting was achieved, however, it was found that the lines were nearly invisible regardless of the color or brightness of the background. For example, a clean blackboard, uniformly lighted, proved to be a very poor background. On the other hand, if the blackboard was covered with a network of chalk lines, the visibility of the lines was much improved. That is, the glycerine lines appeared to refract the light as though they were composed of a succession of very small optical prisms.

Numerous backgrounds have been tried, but the best found thus far consists of any light-colored paper folded in a pleated arrangement and lighted from two directions, as shown in Fig. 1. This arrangement provides a multiplicity of lights and shadows of varying intensity.

Three Test Arrangements Reported

The test arrangements here reported are shown in Figs 2(*a*), 3(*a*), and 4(*a*). A typical arrangement is given in Fig. 2(*a*), where the glycerine is caused to flow by gravity through a rectangular baffled channel, and the discharge is controlled by a quick-opening valve. The inside channel dimensions were 2.6×0.8 in. When the glycerine flows from the reservoir into the channel, it passes through a screen, which causes a number of lines to appear in the glycerine. If the screen is not used, the lines will appear at the boundary and will gradually develop across the section. For the short test section used in these experiments, however, the lines were not clearly evident in the center of the channel before the test specimen was encountered. The use of the screen will provide as many lines as desired, depending on the fineness of the screen.

With this arrangement, and with regard to the physical properties of the glycerine, it was not possible to obtain Reynolds numbers greater than about 20. At higher values it is not certain that the flow pattern would be sufficiently clear to be useful. The reason is that as the speed increases the number of lines increases until they are so numerous and so fine that individual lines cannot be distinguished from one another.

The glycerine used in the examples was not pure since it contained about 4 percent of water in solution. Its specific gravity was 1.245 to 1.250 at 75 deg F. For this solution, the kinematic viscosity is about 370×10^{-5} sq ft per sec. The reason for using this concentration is that glycerine is hygroscopic and readily absorbs water from the atmosphere to this amount. Tests were also made using greater percentages of water in solution. However, the lines were too faint to be easily useful when the percentage of glycerine was less than 70. At the latter value, at 75 deg F, the kinematic viscosity is 15×10^{-5} sq ft per sec, so that a substantial range of values is provided.

Photographic Results Achieved

There is one feature about all the accompanying photographs that should be emphasized. They are taken from motion picture films made to render the flow patterns visible to a seated audience. This required that the depth of focus be sufficient to include the entire channel. The effect of light curvature was thus integrated through the entire thickness of the liquid. Since a velocity profile is present, the integrating effect makes the lines more pronounced, but somewhat blurred. For careful study, the photograph should be taken with a depth of focus of about one-eighth of an inch. In such photographs the lines appear very fine and distinct and can be followed with precision. Many such photographs have been taken, but since they do not reproduce as well as those shown, they are not presented here.

Photographs are shown for the three test arrangements previously referred to—in Fig. 2 for the baffled rectangular channel, in Fig. 3 for the round pipe in which a disk is mounted, and in Fig. 4 for the annulus between an inner rotating cylinder and an outer stationary cylinder.

The first case is that of flow through a rectangular Plexiglas channel containing two baffles, as shown in Fig. 2(*a*). This flow pattern would be of interest in the case of certain types of heat exchanges. Figs. 2 (*b*) and (*c*) show the flow patterns for Reynolds numbers equal to about 1 and 6 respectively, taking the characteristic length equal to the hydraulic radius of the channel proper. In Fig. 2 (*b*) the streamlines are shown against the pleated background. At this low Reynolds number, it can be seen that the pattern is a close approximation to that which would exist for the flow of an ideal fluid. In the case of Fig. 2 (*c*), it can be seen that there is an eddy behind each baffle and the separation streamline is fairly distinct. The critical Reynolds number for the formation of the eddy was found to be about 2.2.

The flow pattern for the round-pipe arrangement of Fig. 3 (*a*) is shown in Fig. 3 (*b*). The round pipe is run through a square tank filled with glycerine to eliminate the distortion brought on by the curvature of the pipe. For this case the Reynolds number is approximately 10, based on the pipe diameter.

Flow patterns obtained with the annulus arrangement sketched in Fig. 4 (*a*) are shown in Fig. 4 (*b*), (*c*), (*d*), and (*e*). The photographs in (*b*), (*c*), (*d*), and (*e*) show various stages in the development of the secondary flow pattern in the case of motion between co-axial cylinders, with the inner wall of the cylinder rotating and the outer wall stationary. The photographs illustrate the fact that this technique appears to be particularly advantageous for the study of the formation and development of unstable flows.

Conclusions Drawn from Work to Date

From the work accomplished up to this time, it appears that this technique will be most fruitful if applied to the study of flows at low Reynolds numbers, to the development of secondary motions, and to the development of instabilities in a flow regime. From brief experiments it appears that surface instabilities can also be studied. The streamlines just below the surface become slightly unstable before surface waves become apparent. Flow patterns involving irregular boundaries may be obtained with ease in the case of either two- or three-dimensional flows.

Although the nature of the phenomenon of photoviscosity in glycerine is not fully understood at this time, it nevertheless is a useful tool. It is hoped that further application in other laboratories will shed some light on the physical or chemical reasons for this phenomenon.

Poor aggregate deposits made usable

by sink-float refining process

JAMES F. LYNCH, JR., Jun. M. ASCE
Western Pacific Railroad, Elko, Nev.

THROUGHOUT the world enormous quantities of portland cement concrete and bituminous concrete are being used in the vast construction operations that characterize this age. As these great construction operations continue, suitable natural deposits of sand and gravel become difficult to find. As time goes on it will become more and more necessary to exploit less desirable deposits by separating the unsatisfactory particles from the sound ones. More economical and efficient processes for such separation are already being sought, and will be essential in the near future.

According to the standard specifications of the American Association of State Highway Officials, satisfactory aggregate for bituminous road and plant-mix surfaces is crushed stone, crushed slag or crushed gravel, of uniform quality, crushed to size and composed of sound, tough, durable pebbles or fragments of rock or slag, and free from clay balls, vegetable matter and other deleterious substances. The American Society for Testing Materials lists substantially the same general requirements for portland cement concrete aggregate, with additional provisions limiting the amounts of such undesirable materials as soft fragments, coal, lignite, and clay lumps. Soft fragments are not to exceed 5 percent; coal and lignite, 1 percent; and clay lumps, 0.25 percent, all by weight.

The Bureau of Reclamation of the U. S. Department of the Interior in its *Concrete Manual* makes the statement:

"Specific gravity is a useful quick indicator of suitability of an aggregate; low specific gravity frequently indicates porous, weak and absorptive material, and high specific gravity often indicates good quality."

Thus if an efficient method of separating material of high specific gravity from that of low specific gravity can be found, the percentage of harmful substances can be reduced and the aggregate made to conform to the stated limits.

Such a process—called the sink-float or Heavy-Media Separation Process—has been known to the mining industry since 1936. No more special knowledge is required to understand this process than is needed to understand simple hydraulic classification as commonly practiced every day by sand and gravel producers in the separation of different sizes of commercial sand. The only difference is that instead of using plain water and depending on size to effect a separation, media of greater apparent specific gravity—heavy media—is used and the difference in specific gravity is employed to effect separation.

TABLE I. REPRESENTATIVE SINK-FLOAT MILLS

Designed to treat materials in size range of $-2\frac{1}{2}$ in. to + No. 10 sieve

Number	Drum Size, ft	Overall Height	Width	Length	Weight, lb	Capacity, tons per hr	Cost FOB Factories
1M	4 × 4	17 ft 9 in.	13 ft 10 in.	25 ft 5 in.	33,100	4 to 20	$ 25,050
3M	6 × 5	20 ft 7 in.	16 ft 3 in.	34 ft 0 in.	65,820	20 to 70	44,720
5M	10 × 8	28 ft 3 in.	30 ft 0 in.	52 ft 6 in.	173,160	84 to 275	112,080

Note: Mobil-Mills listed above are manufactured by Western Machinery Co. The Heavy Media Separation Processes described in this article are licensed by the American Zinc, Lead and Smelting Co. Their sole technical and sales representative for these processes is the American Cyanamid Co., New York, N. Y.

The process is able to make sharp separations at any predetermined specific gravity ranging from 1.25 to 3.40, and to continuously maintain this gravity within ±0.01. There is no upper limit on the size of the material to be processed other than that imposed by the size of the plant. However, the method will not efficiently handle material finer than those particles retained on a No. 10 sieve, as fines affect the specific gravity of the media.

Primary treatment of the material consists entirely of crushing and screening. The following flow process and description, while representative, is not the only method used, as plants with capacities ranging from 8 tons per hour to 2,000 tons per hour are in use today. See Fig. 1 for a typical flow sheet.

After screening, the aggregate is fed directly to the separating vessel, usually an open-top inverted cone or a rotating drum (Fig. 2) containing the media. This media may be said to be "homogenized"; it is a suspension of some finely ground material, usually ferro-silicon or magnetite in water. Both magnetite and ferro-silicon are ground to 100 percent passing the No. 65 sieve. Magnetite (Fe_3O_4) is a mineral that occurs naturally in many parts of the world, while ferro-silicon is an alloy composed of 85 percent iron and 15 percent silicon.

Immediately after the material has entered the cone, separation takes place in a shallow zone depending on the height of the cone, about 18 in. from the top of the vessel. The lighter material floats over an outflow weir located opposite the feed mechanism, while the heavier material sinks through the separating zone and is caught in an updraft generated by an airlift which lifts the sink product along with the media through a tube to the drainage screen. The airlift provides a continuous and almost foolproof method of elevating the sink product. However, it is very inefficient as far as power consumption is concerned and is one of the main factors that limits the size of material that can be handled.

Both the sink and float products are discharged onto the same vibrating screen, which is divided longitudinally to keep the products separated. Here more than 90 percent of the media adhering to the particles is reclaimed. The particles then move to another vibrating screen with water sprays overhead, which remove the remaining media. The aggregate is now completely processed and is discharged to stockpiles or, in the case of the float product, is wasted. The rest of the process involves recovery of the media from the wash water.

The media removed by washing is too dilute to be returned to the system and accordingly is treated in a novel manner as follows: The diluted media from the wash-water sump passes first between a set of magnetizing blocks which serve to change the charge on the particles, whereby they become mutually attracted and flocculate. Immediately thereafter they pass through a media thickener. Next magnetic separators clean the thickened media by rejecting the non-magnetic fines. The media then flows into the densifier, where the specific gravity is adjusted, through a demagnetizing coil, and back into the system through the media sump.

This process was used in the construction of an air-strip at Rivers, Manitoba, 6,000 × 200 ft, capable of supporting 180,000-lb aircraft. The project required 120,000 cu yd of concrete. The nearest source of commercial aggregate was near Winnipeg, 165 miles away, while the locally available aggregate contained approximately 2 percent of shale in the +1-in. range and 5 percent in the 1-in. to +No. 10 sieve range. The obvious way to eliminate the shale was by specific gravity, for the shale had a specific gravity of 2 while the usable minerals had a specific gravity greater than 2.6.

All gravel was processed by the sink-float method, and tests showed the density of the resulting concrete to be 156 lb per cu ft, using a cement content of 6.7 bags per cu yd and a water cement ratio of 0.47 by weight. Compressive strength ran from 4,170 psi at 7 days at 6,300 psi at 28 days.

Operating costs vary greatly with locality, materials to be treated and size of plant. The normal operating costs of the Mobil-Mill used on the Manitoba air-strip project, including royalty, were about equivalent to a local truck haul of two miles. In general, direct operating costs, including labor, power, media, maintenance and supplies, have been found to average between 8 and 50 cents per ton of feed. Western Machinery Co. states that a cost of 8 cents per ton of crude ore handled

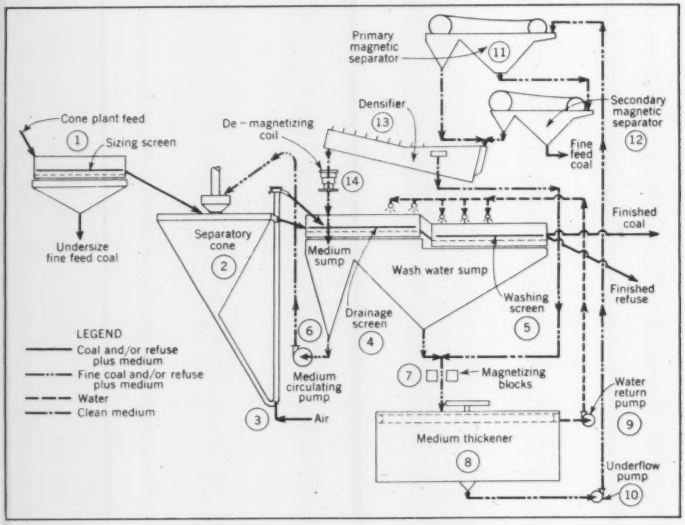


FIG. 1.

Procedures in heavy-media method of separation are shown by standard flow sheet.

can be obtained in units processing 275 tons per hour, while in plants handling 4 tons per hour, costs might run as high as 60 cents per ton handled. Dimensions and other facts about representative plants manufactured by this company are given in Table I. Installation costs and time vary greatly according to local conditions. A No. 3M-Mobil-Mill has been set up in 36 man-days.

Borrow containing suitable material in desired quantities can be processed regardless of the amount or type of impurities, provided there is a difference of 0.05 between the specific gravities of the usable material and the deleterious components. While it is my opinion that the chief advantage of the process lies in its efficient rejection of materials that do not dissolve in water, the method has been modified to remove materials that do dissolve in water. The American Cyanamid Co. believes that, besides removing shale, clay balls and other strength-affecting materials, the process can be useful in rejecting reactive and color- or stain-producing components from aggregate.

Another advantage claimed is the reduction of the amount of processing water required. As for coal beneficiation, the Nelson L. Davis Co. in its bulletin, *Heavy Media Precision Processor for the Coal Industry*, states that "This system uses from 10 to 25 percent of the processing water formerly used in other types of cleaning systems. Therefore less water clarification facilities are required."

Required control of the feed consists, as previously stated, in sizing and removing the fines. Although the efficiency of the process in general falls off when material finer than No. 10 mesh is introduced into the separating vessel, a plant is successfully treating iron ore in the range of − No. 10 mesh to + No. 65 mesh, using a somewhat modified flow sheet. Other standard plants are treating particles in the No. 16 and No. 30 mesh class.

It is true that this process is relatively new and untried for gravel beneficiation. However, Heavy-Media Separation is now considered to be standard practice in the treatment of more than 20 minerals, and 140 commercial plants are operating or being built with a yearly capacity of upwards of 50,000,000 tons of feed. The first commercial application in the mining industry, the Mascot Mill of the American Zinc Co. of Tennessee, started operation early in 1936.

As commercial supplies of sand and gravel dwindle, necessitating the use of lower-grade deposits, and as new means of lowering material and transportation costs are sought, it is believed that the sink-float process should have an ever-increasing future in the production of satisfactory materials of this type.

Gratitude is expressed to Valdamar F. Larson of the Mackay School of Mines; to Prof. H. B. Blodgett, M. ASCE, and H. Robert Hammil, Jun. M. ASCE, of the Department of Civil Engineering of the University of Nevada; to R. W. Hedges of the American Cyanamid Co.; to John Hamm of the Western Machinery Co.; and to the authors of the various articles and bulletins consulted, for their generous help in securing material and suggestions for the preparation of this paper.

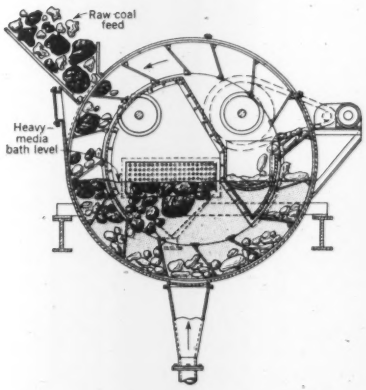
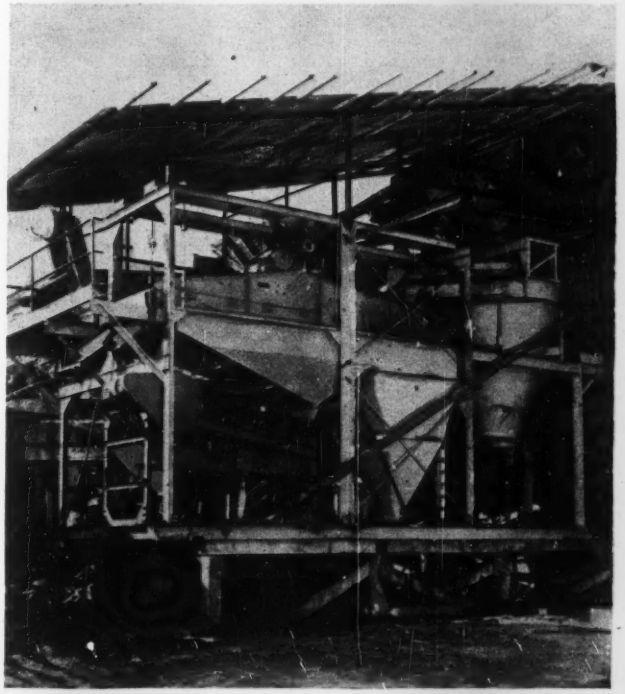


FIG. 2. Drum-type separation vessel of Nelson L. Davis Co., Chicago, Ill., is shown in vertical cross section. Clean coal floats and rejects sink in heavy media composed of magnetite and water. Same process can be used to separate aggregates providing only that there is a difference of 0.05 between specific gravity of usable material and that of deleterious components.



EIGHTY tons per hour of bituminous coal is separated from refuse for a Pennsylvania coal company by Mobil-Mill with cone-type separator with internal air-lift. Mill, seen at right, was made by Western Machinery Co.

Controlled Materials Plan—

IN THIS explanation of the CMP, facts of importance to sanitary engineers are abstracted from the transcript of the hour-long panel discussion, which was sponsored by the Sanitary Engineering Division and held during the Annual Convention of ASCE. Besides the moderator, A M Rawn, Vice-President of ASCE and Chief Engineer and General Manager, County Sanitation Districts of Los Angeles County, the panel members were: Harvey Howe, Consultant, Water Resources Division, National Production Authority; Louis R. Howson, Director ASCE, consulting engineer; Harry L. Conrad, President, The Christman Company; Milton P. Adams, Executive Secretary, Water Resources Commission of Michigan; Frank Conover, The Dorr Company; and Stanley C. Martin, Chief of Field Operations, Federal Water Pollution Control Advisory Board, all members of ASCE.

IN OPENING the panel discussion the moderator, Mr. Rawn, called on Mr. Howe, as consultant to the Water Resources Division of the National Production Authority (NPA), to outline the CMP and the policies of its enabling agency, the NPA.

MR. HOWE: The CMP is a plan for the distribution of scarce basic materials which was used during World War II to good advantage and was found to be about the only plan that worked—the priority system as such broke down quite early. The materials now under control are steel, copper, and aluminum. Under the plan a number of claimant agencies in Washington put in claims for their individual programs. There are many of these agencies but the one that concerns us here is the Water Resources Division, controlling water and sewerage works. There are also the industry divisions, which are charged with the responsibility of controlling production of the so-called "B" products [loosely defined as the manufactured products of industry].

The claimant agencies and the industry divisions prepare estimates of their requirements for future quarters. These quarterly requirements are forwarded to the Program and Requirements Committee of the DPA in Washington. At the same time, the Iron and Steel Division, Copper Division, and Aluminum Division prepare estimates of the total amount of these materials that will be produced in the same quarter.

These factor of supply and demand must be brought into balance. The indicated requirements are from 140 percent of estimated production up. The NPA apportions the materials on the basis of relative necessity and the judgment of those in charge, and the resulting allotments are communicated to the various claimant agencies and industry divisions. Finally, these agencies and industry divisions distribute the material allotted to them on the basis of applications.

The Water Resources Division of NPA is set up to receive 4C applications and to act on them within the limits of the materials allotted to it by the Program Requirements Committee of DPA. During the fourth quarter the Division was given what I would consider something less than an adequate amount of materials, but still I think it fared better than it might have—better than some others.

The allotment for the first quarter of 1952 is definitely inadequate, and many applications must be postponed or denied. Actually it is a matter of postponement beeause the Division believes that water and sewerage works should go forward as far as the material situation will allow. There is no higher authority to overrule the decisions of the Division, once they are made.

MODERATOR RAWN then called on Mr. Conrad, who spoke from the contractor's point of view.

MR. CONRAD: There are a few factors that people misunderstand. After an allotment is approved it is up to the contractor to find the material. Approval of the allotment is, as it were, a "hunting license" [that is, it is still necessary to find a mill that will fill the order].

Unfortunately, too many owners are putting forth claims far beyond their needs, which builds up unusual demands for materials. The entire thing will fall down if the industry does not cooperate to the extent of being fair.

MODERATOR RAWN next asked Mr. Conover to explain the procedure of the owner or engineer in helping the manufacturer to secure materials.

MR. CONOVER: The relationship that the manufacturer has to the product, as we experience it with the industry divisions of the NPA down in Washington, has been very clear and very simple. The manufacturer of Class B products simply makes out his 4B application, mails it in and in due course gets back allocations of materials and proper DO ratings.

Manufacturers are not required by present regulations to confine their activities to the production of Class B products that have a DO rating. We are required, of course, to keep those with the DO rating on an agreed production schedule. I am therefore making a plea that everybody [who is entitled to it] get the DO rating.

MODERATOR RAWN asked Mr. Howson to outline the role the engineer plays in obtaining the necessary priorities.

MR. HOWSON: First I should like to comment that, from the consulting engineer's standpoint I think the Water Resources Division, which has been in existence only three months—it was one of the last claimant agencies to be organized—has really done a service to the water and sewage disposal industry.

One of the responsibilities that usually falls to the consulting engineer is to make out the materials application for his client. In so doing he has a definite responsibility to review his designs in the light of the use of critical materials and to study the availability of substitutes. I don't think the study should be limited to economic practicability because, in what is substantially a war effort, we have responsibilities other than costs alone. Furthermore, our applications should be realistic; they should state just what we need. They should be specific and arranged with respect to timing.

I think we should make our applications at least two quarters in advance of need. Sometimes that will be in advance of the full development of detailed plans, but every designer of a specific type of structure has from past experience certain units, for instance reinforcing per cubic yard of concrete, that will be adequate. Timing seems to be of more importance than the extreme refinement that comes with detailed plans.

Then these people in Washington have a responsibility to put first things first. Many sanitary works meet definite health requirements; some are built as a result of governmental orders. Where these conditions exist they should be specifically made known to the claimant agency.

Some questions answered

MODERATOR RAWN threw the meeting open for questions from the floor.

QUESTION: I have a couple of questions. First, in the event that an application is granted for a specific quarter but the hunt to find the materials is not successful, is that application considered, without refiling, as a request for allotment in a subsequent quarter?

Second, if an allotment for a specific quarter cannot be used in that quarter and the Water Resources Division is advised of its non-use, will it be necessary to file a new application? Also, in the cases just mentioned, are the applications thrown into the basket for consideration in the subsequent quarter, or do they have a priority status?

MR. HOWE: First, you cannot carry an allotment over from one quarter to the next except under one condition, and that is if your order has been placed with a supplier and has been accepted by him. In all other cases a new application must be filed. However, this new application, by virtue of its prior approval, will be given preference by the Water Resources Division. In any case of reapplication, a "J" number is given, and that is the control number that carries through the case. Every reapplication should be tied in with the previous application for the same work.

QUESTION: Can an applicant determine for himself whether or not his project has a high priority or a high degree of essentiality?

MR. HOWE: There is no general publication of the standards by which the applications are judged, but roughly, urgent public health needs would be a basis for approval. Direct support of AEC or military projects carries high priority, also direct support of defense production.

Another point, which is becoming less important as time goes on, is the actual percentage of completion. It was not, according to Mr. Fleischman, the intention to stop any projects substantially under way—60 percent complete I believe is the figure he used. Regardless of essentiality, it was felt that, if a project had gone that far, materials had been tied up, and all such projects should be completed.

Many applications received by the Water Resources Division are made out by a city on the basis of the contracts being let, a logical way to do it. However, such contracts will show no percentage of completion even though they may be the completing link of a large program. It may be that an expenditure of a million dollars will put a five-million-dollar project into operation. In such a case it is proper for the application to show 80-percent completion, and for the supporting letter to point out that this is the final link which will actuate a great deal of previous construction. In certain cases the Water Resources Division has postponed applications which would not have been held up had it been informed of the actual situation.

QUESTION: How do the water and sewage priorities compare with other non-defense requests, and can anything be done to step up their rate?

MR. HOWE: I think you will always find that when you start trying to control the economy of a country of this size and you try to do it with 6,000 or 7,000 people in Washington, you are going to get dislocations and even obvious misuse of materials. Every effort is being made to coordinate and to have a common standard by which the essentiality of construction is judged, but I don't think you will ever find it working perfectly.

QUESTION: In a large project, are we justified in spreading our application, say, over the four quarters of next year or should we apply quarter by quarter? It puts us in a spot not knowing exactly how to bid a job and what to tell the contractor. He is not inclined to sharpen his pencil if he doesn't know where he stands.

MR. HOWE: That point has caused a great deal of discussion in Washington. When an allotment is handed down to a claimant agency, it is generally permitted to allot for advance quarters up to certain percentages. I believe it ran about 70 or 75 percent for the first quarter, 65 percent for the next, and trailed down to a point some five or six quarters away, where we were allowed to allot up to 5 percent. The Water Resources Division chose to interpret this ruling that it could allot the entire amount of materials requested, as in the case of a four-quarter project, to allot all of the materials for that period. The only point at which it stops is when it runs out of materials.

The worst thing that could happen, of course, is that a project would be stopped because the material situation had become more critical. I do think that the builder should apply for the entire project. A few road blocks may be thrown in the way of the Division so that it would be required to make the allotments by successive quarters. I am hoping not. It is evident that a contractor is going to put a higher contingency item in the bid if he isn't reasonably well assured as to the flow of materials.

QUESTION: In the case of an application for a job that will run through 1942, does the Division make a decision in time so that the builder will know where he stands in advance of the first quarter? Or will he have to wait until the quarter actually starts?

MR. HOWE: He should definitely hear in advance, and well in advance, because of the lead time necessary to get on the mill schedules. The lead time for carbon steel, for instance, is 45 days.

QUESTION: On the allotment form sent in to the Water Resources Division, the pounds of materials allocated to the contractor are listed. Then there is a dollar value. Is it correct to assume that the dollar value applies to the motors, switches and other apparatus that go into the job, and that the pound values should not include, for instance, the weight of copper that goes into a motor or switch?

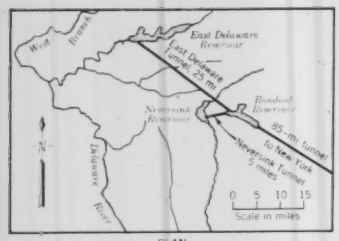
MR. HOWE: That is correct. Do not include under controlled materials the materials that make up the B products. That quantity is shown on the lower two lines of the application in dollar value. You will be helping the Water Resources Division tremendously, and yourselves also eventually, if you will send with your application an auxiliary sheet on which you list your motors by capacity and size and approximate dollar value—or your hydrants, or whatever. Do not show the materials going into the B products but do list the B products on the auxiliary sheet and show their approximate dollar value.

In the first place such an auxiliary sheet tells the Water Resources Division what they are extending DO ratings on. In the second place, it gives them statistical information so that, as the quarters pass, they will be able to work with the industry divisions which control the production of B products, and will be better able to keep the production of B items in balance with the general construction program which they are approving.

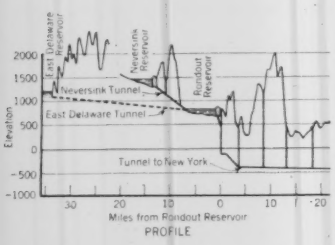
New York's Delaware Aqueduct develops

GEORGE R. RICH, M. ASCE

Partner, Chas. T. Main, Inc., Boston, Mass.



PLAN



PROFILE

FIG. 1. TWO POWER PLANTS described in this article are located at ends of two tunnels which lead into Rondout Reservoir. Plant of Central Hudson Gas & Electric Corp. is at end of 5-mile Neversink tunnel, and plant of Rockland Light & Power Co. is at end of 25-mile East Delaware tunnel. These tunnels, here seen in map and profile, form part of New York's new Delaware Aqueduct.

FIG. 2. (Below) East Delaware plant must operate on base load because of tunnel discharge requirements for city water supply.

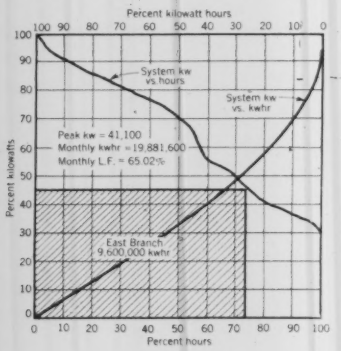
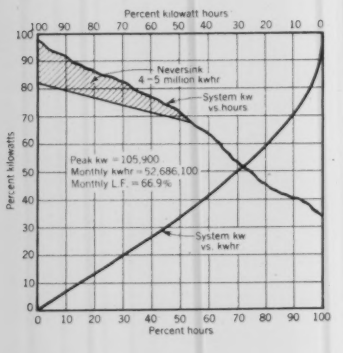

Percent kilowatt hours
100 90 80 70 60 50 40 30 20 10 0
System kw vs. hours
System kw vs. kwhr
Peak kw = 41,100
Monthly kwhr = 19,881,600
Monthly L.F. = 65.02%
East Branch 9,600,000 kwhr
Percent kilowatts
Percent hours
0 10 20 30 40 50 60 70 80 90 100

FIG. 3. (Below) Neversink plant is assigned to peaking service.


Percent kilowatt hours
100 90 80 70 60 50 40 30 20 10 0
Neversink 4-5 million kwhr
System kw vs. hours
Peak kw = 105,900
Monthly kwhr = 52,686,100
Monthly L.F. = 66.9%
System kw vs. kwhr
Percent kilowatts
Percent hours
0 10 20 30 40 50 60 70 80 90 100

THE NEVERSINK and East Delaware hydroelectric power plants are interesting examples of cooperation between the board of water supply of a large metropolis and private utility corporations. The result is a multipurpose development yielding water supply for the metropolis and incidental generation of electrical energy for the utilities. The joint enterprise is noteworthy as an instance of advance cooperation between legal, engineering and business interests at the inception of a project, in ample time to avoid expensive litigation and to assure the best over-all solution to the problem.

In this case two New York State utilities, the Central Hudson Gas & Electric Corp. and the Rockland Light & Power Co., had acquired power sites on certain streams before the City of New York secured the right, by condemnation proceedings, to divert the flow of these streams into the Delaware water supply system. In such cases the utilities usually institute law suits for monetary damages, but in the present instance the availability of energy for power generation at the outlets of the two tunnels (Fig. 1) formed the basis of an agreement.

Each utility is permitted to construct a hydroelectric plant, one at the end of the Neversink tunnel, and the other at the end of the East Delaware tunnel. Both tunnels empty into the Rondout storage reservoir, and the water utilized by the power stations will be consumed by the city. After fifty years the plants will revert to the city; in the interim, revenue from the sale of power will amortize the damage sustained by the power companies, the cost of the power stations, and additional transmission-line construction. Moreover, the city will obtain a material revenue from excess water used for power generation.

Somewhat similar examples of power generation as an adjunct to water supply are afforded by the Hetch Hetchy development of the City of San Francisco, the Cobble Mountain Reservoir of Springfield, Mass., and the Quabbin Tunnel of the Boston Metropolitan District Water Supply.

The pertinent elements of New York's Delaware project with respect to power features are the 25-mile East Delaware tunnel, which connects the East Delaware (or Pepacton) Reservoir with the Rondout Reservoir, and the 5-mile Neversink tunnel, which similarly connects the Neversink Reservoir with the Rondout Reservoir (Fig. 1). The gross available head on the 11-ft 4-in. East Delaware tunnel is 440 ft; the corresponding gross head on the 10-ft-dia Neversink tunnel is 550 ft.

Because of the large friction head loss of about 100 ft in the East Delaware tunnel, the maximum power output is obtained by operating at a velocity of about 7 fps. To meet the water supply requirements of New York, it will be necessary to discharge water continuously at this velocity 24 hours a day, 5 days a week. Accordingly the East Delaware plant of the Rockland Light & Power Co. must operate on base load (Fig. 2).

hydroelectric power

FIG. 4

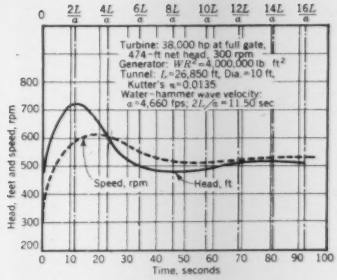
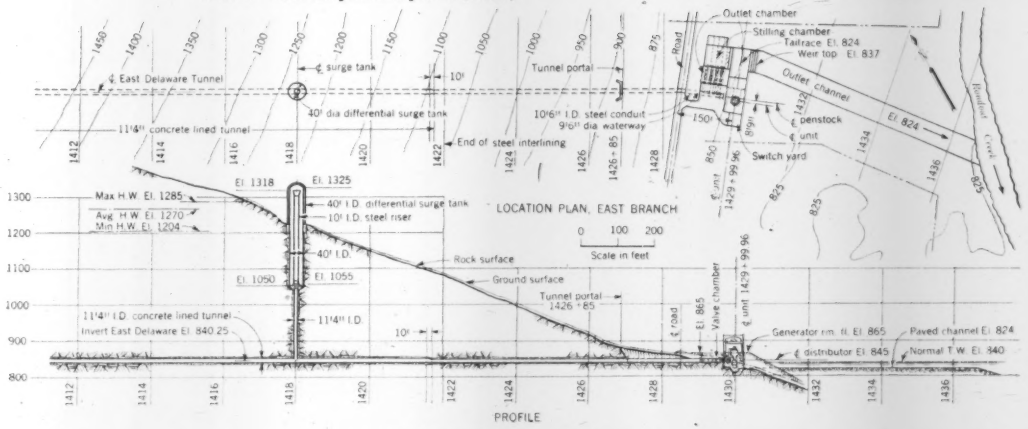

Turbine: 38,000 hp at full gate, 474-ft net head, 300 rpm
Generator: WR^2=4,000,000 lb ft²
Tunnel: L=26,850 ft, Dia.=10 ft,
Kutter's n=0.0135
Water-hammer wave velocity: a=4,660 fps, 2L/a=11.50 sec
Head, feet and speed, rpm
Time, seconds
Speed, rpm
Head, ft

FIG. 5. Location plan and profile (below)



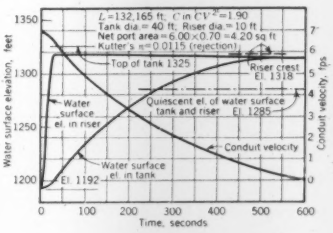

L=132,165 ft, C in CV²=1.90
Tank dia.=40 ft, Riser dia.=10 ft
Net port area=6.00×0.70=4.20 sq ft
Kutter's n=0.0115 (rejection)
Top of tank 1325
Riser crest El. 1318
Water surface el. in riser
Quiescent el. of water surface tank and riser El. 1285
Conduit velocity
Water surface el. in tank
El. 1192
Water surface elevation, feet
Conduit velocity, fps
Time, seconds

FIG. 6

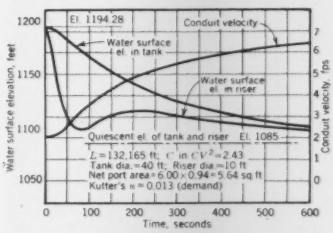

El. 1194.28
Conduit velocity
Water surface el. in tank
Water surface el. in riser
Quiescent el. of tank and riser El. 1085
L=132,165 ft, C in CV²=2.43
Tank dia.=40 ft, Riser dia.=10 ft
Net port area=6.00×0.94=5.64 sq ft
Kutter's n=0.013 (demand)
Water surface elevation, feet
Conduit velocity, fps
Time, seconds

FIG. 7

AT NEVERSINK PLANT, where topography at outlet portal of 5-mile tunnel is unfavorable for surge tank, rise in water-hammer pressures is controlled by special pressure regulator. Turbine speed performance curve is shown in Fig. 4. On 25-mile East Delaware tunnel, differential surge tank was feasible (Fig. 5). Performance curves for this tank are given in Figs. 6 and 7.

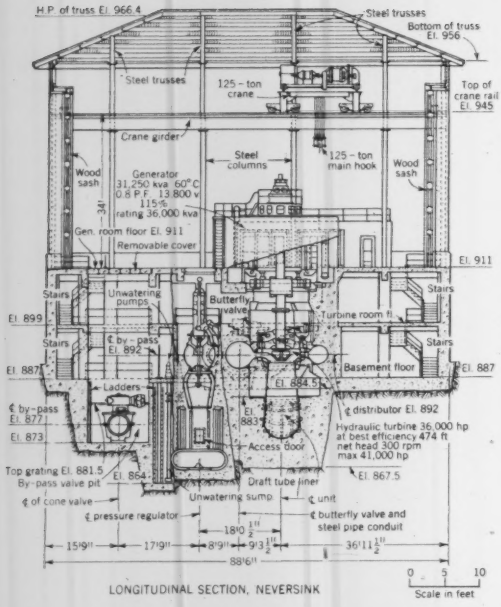
The Neversink tunnel velocity of 10 fps permits passage of the city by operating 8 hours a day, 5 days a week, enabling the Central Hudson Gas & Electric Corp. to assign the Neversink power station to peaking service (Fig. 3). Both utilities are well supplied with energy from steam plants.

The Neversink station will be manually operated, while the East Delaware station will be operated by remote control, with an operator in attendance locally. The plant will be controlled by a code selector supervisory system from a central point in Middletown, N.Y., about 35 miles away.

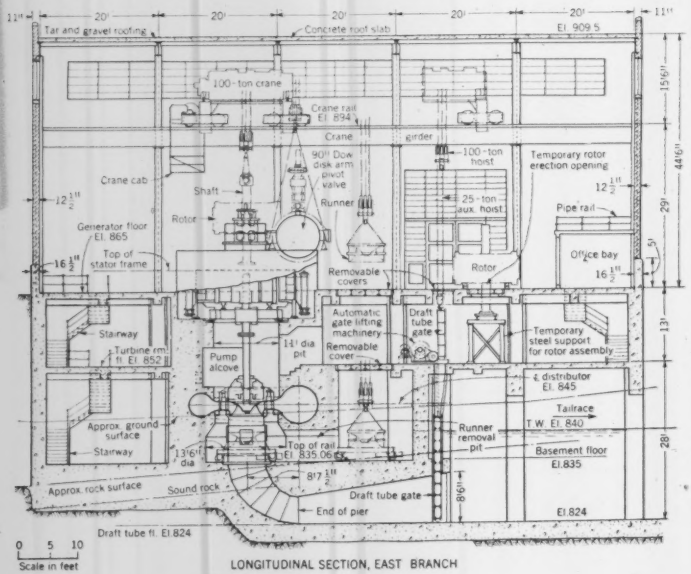
Surge and water-hammer control are important elements in the design of both plants. Unfavorable topography at the outlet portal of the Neversink tunnel renders the cost of a surge tank prohibitive. The closure time for the tunnel flow is specified to be not less than 200 sec (opening or closing) so that the ordinary rise in water-hammer pressure will be limited to about 20 percent. To avoid operating the generating unit at runaway speed for such a long period of time, a pressure regulator has been provided, as shown in Fig. 8, page 46.

To accommodate emergency full-load rejection, the turbine gates are designed to close in 4 sec. During this time the pressure regulator opens fully, and at this opening is capable of discharging the full-load flow. If for any unforeseen reason, the relief valve in the pressure regulator should stick and fail to open, the connecting rod to the gate-shifting mechanism is capable of sustaining the full stalling force of the turbine-gate servomotors, and the port opening in the relief-valve dashpot has a size such that it slows the time of closure of the turbine gates to 200 sec under this condition.

If however, owing to some very remote but entirely conceivable contingency, the turbine wicket gates should stick and fail to close under full-load short-circuit rejection, then the turbine speed would start to rise, but because of the overspeed characteristic of a Francis turbine of this type, the discharge would start to decrease just as effectively as if a



LONGITUDINAL SECTION, NEVERSINK



LONGITUDINAL SECTION, EAST BRANCH

FIGS. 8 and 9. TURBINES for both plants are almost identical in physical size. At point of best efficiency, Neversink turbine (Fig. 8, above) rated at 36,000 hp at 474-ft net head is protected by special pressure regulator. East Delaware turbine (Fig. 9, below) is rated at 25,000 hp at 327 rpm, 330-ft net head. Both turbines have self-supporting upper draft-tube section out of contact with concrete, with adequate space to permit withdrawing runner and wicket gates entirely from below.

penstock valve were being shut. The reduction of discharge in turn would serve to pyramid the water-hammer and overspeed, with consequent magnification of the vicious circle. The remedy is to provide sufficient rotating inertia (WR^2) in the generator rotor to slow down the acceleration of overspeed and the pressure rise to acceptable values. Performance for the installed WR^2 of 4,000,000 lb-ft^2 is shown in Fig. 4. The resultant pressure is 27 percent above the static maximum, and the speed is about 100 percent above normal. The performance curves show rapid damping to quiescence, indicating the fundamental stability of the system as designed.

For daily routine shutdowns, the generator is unloaded very gradually (in 300 sec) by means of a slow-motion motor-operated reduction gear working through a friction drive on the gate-limit device on the actuator. Because the reduction gear operates through a friction drive, it is still possible for the operator inadvertently to turn the gate-limit knob in the usual short time, but in this event no harm will result since, with the turbine gate closing time of 4 sec, the relief valve will be brought into operation automatically. For routine starting, the unit is synchronized to the line with the gate limit set at speed-no-load, and after synchronizing, the gate limit is opened slowly by the motor-operated reduction gear. The opening ports in the main relay valve are adequate to open the gates through a full stroke in not less than 200 sec.

Two 90-in. electrically operated butterfly valves are provided ahead of the scroll case. The operating time is 300 sec and control is provided at the actuator panel. The valve bodies are made of cast steel in one piece and are provided with a removable stainless-steel seat ring to secure watertightness between the seat ring and the valve disk. These valves were tested hydraulically at 475 psi in both shop and field.

Surge Tank Provided at East Delaware Plant

At the East Delaware outlet portal, the topography is favorable to the construction of a surge tank (Fig. 5). An economic study involving the costs of steel plate, rock excavation and generator WR^2 dictated that the upper 100-ft height of tank be constructed of plate steel and the remainder in the rock hillside. The resulting length of penstock, in combination with low penstock velocity, affords satisfactory regulation for the readily obtainable generator WR^2

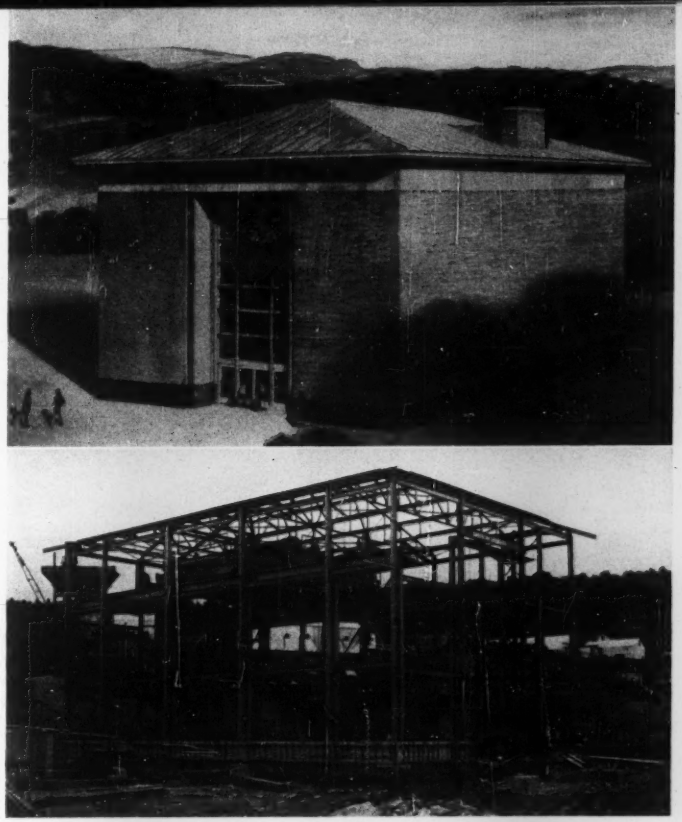
and does not require a pressure regulator for restriction of water-hammer. Performance curves for the differential surge tank are given in Figs. 6 and 7. The port area is given the proper size for "rectangular" action at half-load demand, but the resulting head of the riser drop curve for full-load demand is not excessive for this very rare condition.

In physical size, the hydraulic turbines for the two projects are almost identical. At the point of best efficiency, the Neversink turbine is rated at 36,000 hp at 300 rpm, 474-ft net head. The East Delaware turbine is rated at 25,000 hp at 327 rpm, and 330-ft net head. Both turbines (Figs. 8 and 9) have a self-supporting upper draft-tube section entirely out of contact with the concrete, with adequate annular space to permit withdrawing the runner and wicket gates entirely from below. Stainless steel is used extensively in both turbine installations. Runners and wicket gates are solid stainless-steel castings. Removable throat rings of solid stainless steel are provided at the top of the draft tube just below the runner, and removable and renewable wearing rings are provided in the matching movable and stationary members at points of close runner clearance.

Generators at both powerhouses are of the totally enclosed type, water-cooled by heat exchangers distributed around the stator periphery. They are throat connected directly to metal-clad switch gear, and are equipped with a combined guide and thrust bearing above the stator frame, together with a guide bearing below the rotor.

The Neversink generator is rated at 31,250 kva at a 0.80 power factor and 60-deg C rise; and the East Delaware generator at 20,000 kva at a 0.90 power factor and 60-deg C rise. Both are three-phase, 60-cycle, 13,800-v. The governors in each case are of Woodward Governor Co. manufacture, with cabinet-type actuators and permanent magnet generators for driving the flyball element.

In layout the two stations differ to meet local conditions and the requirements of the individual utility companies. The Neversink switchyard is comparatively large and the generator leads are connected to the transformers in the yard by underground cables in concrete ducts passing through the substructure wall below the generator-room floor. In the East Delaware yard, a single three-phase transformer is located directly outside the brick end wall of the powerhouse superstructure, and connection from the switch gear to the transformer bushings is made by bare copper leads in metal-clad housing located on top of the switch gear and passing through the brick wall.



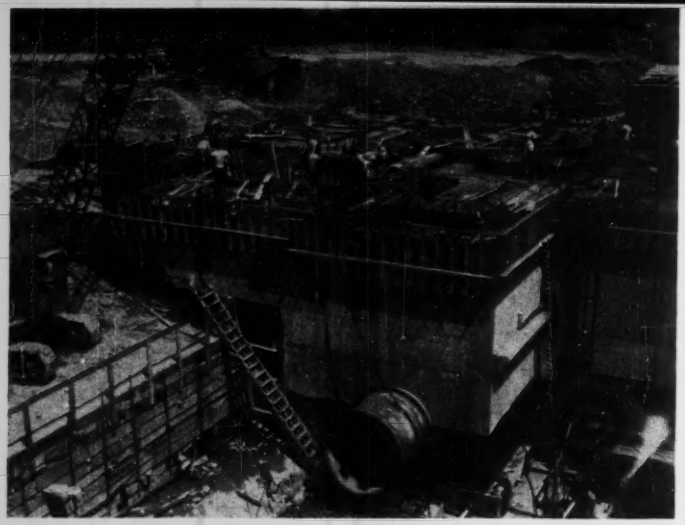
NEVERSINK POWERHOUSE has walls of jumbo brick laid with modified Flemish bond. Combination windows and doors are provided at both ends, with removable section for passing large equipment on south end. Copper-clad hip roof with overhanging cornice was chosen to reduce maintenance. Powerhouse is scheduled for completion in spring of 1953.

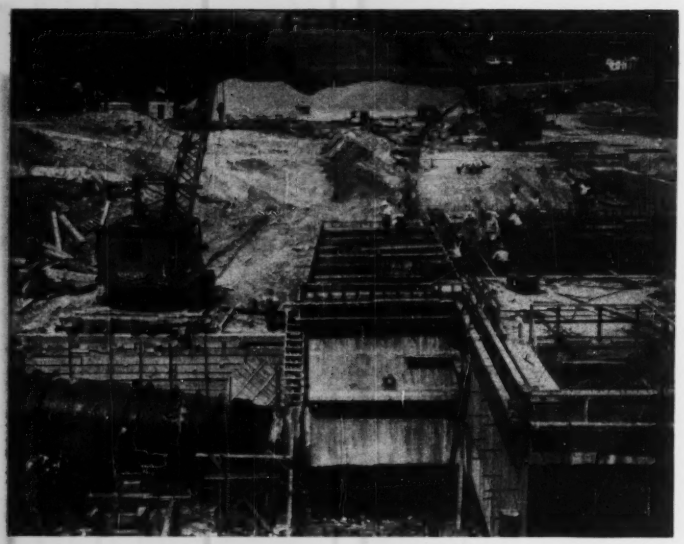
At the Neversink plant the turbine, regulator valve, and city bypass discharge directly into a closed concrete tailrace and then into a 10-ft-dia conduit about a half mile in length, partially in open cut and the rest in a concrete-lined tunnel. This conduit discharges into Chestnut Creek, a feeder of Rondout Reservoir. The tailrace chamber is provided liberally with vents to the atmosphere to ensure that the conduit will function as an open channel so as not to produce water-hammer effects that would have a very adverse effect on the turbine speed regulation. The tailrace conduit is so proportioned as to maintain the tailwater well above the safe level for turbine cavitation under all conditions of operation.

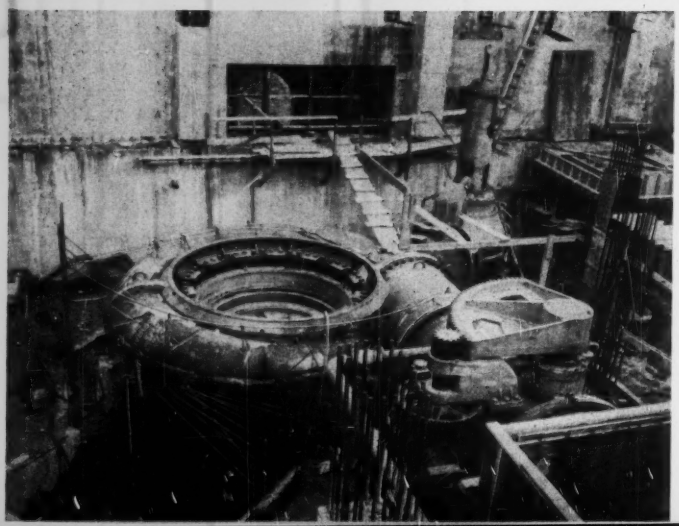
The Neversink tailrace chamber was tested for hydraulic performance at the Alden Hydraulic Laboratory of the Worcester Polytechnic Institute. For these tests a model was constructed having a ratio of 1:15. Flow conditions in the tailrace chamber were relatively quiet for all conditions of discharge. No serious wave action was observed at any time in the tailrace chamber. The model was constructed under the direction of the late Prof. C. M. Allen, M. ASCE, Director, and Prof. L. J. Hooper, M. ASCE, Assistant Director of the laboratory.

At the East Delaware plant, the tailrace is an open channel of the conventional type, but a discharge basin and weir are required to maintain tailwater at the requisite level to prevent turbine cavitation when Rondout Reservoir is drawn down.

The agreement between the City of New York and the Central Hudson







PENSTOCK FOR SINGLE-UNIT Neversink plant enters in foreground of two upper views. Middle view also shows connection for bypass around plant. Water can follow one of three routes—through bypass, through turbine, or through pressure regulator (at far right in lower view). One of two butterfly valves in penstock appears in this same photo, near right foreground.

Gas & Electric Corp. for the Neversink plant provides for the use of 160 billion cu ft of free water over the 50-year contract period and payment to the city of $26.50 per million cu ft for all excess water passed through the plant. Each week the city will notify Central Hudson of the water required for the following week, and the operating schedule will be arranged to pass the amount ordered.

Water is to be measured by a Venturi-type meter, the recording equipment being located in the plant. Essentially, the Neversink plant will utilize for power generation the equivalent foot-pounds of usable energy lost by the diversion of the Rondout at Merriman Dam.

Progress on the Neversink power station has been rapid and it is scheduled for completion in the spring of 1953. Work on the East Delaware station was held up pending completion of the much longer East Delaware tunnel but was started this year, and is scheduled for completion in the spring of 1955.

Executive direction of the activities of the New York Board of Water Supply is exercised by three commissioners, Irving V. A. Huie, M. ASCE, Henry Hesterberg and Rufus E. McGahen. John M. Fitzgerald, M. ASCE, is Chief Engineer, Victor C. Brownson, M. ASCE, Deputy Chief Engineer, and Torris Eide, Assoc. M. ASCE, Headquarters Department Engineer.

O. H. Bundy, M. ASCE, is Executive Engineer in charge of engineering and construction on the Neversink power station for the Central Hudson Gas & Electric Corp., and J. O. Fuchs is Operating Manager.

For the Rockland Light & Power Co., F. L. Lovett is Vice-President and General Manager, in charge of engineering and construction on the East Delaware power station.

W. F. Uhl, M. ASCE, is consulting engineer to the two utility companies and president of Chas. T. Main, Inc., designing engineers for the power station work.

(This article is based on the paper presented by Mr. Rich at the ASCE Annual Convention, before a Power Division session presided over by James P. Growdon.)

Screed-template frame facilitates seating of bridge shoes

THROUGH the years many schemes have been developed for seating the shoes of bridge superstructures on concrete substructures. The use of wet mortar or grouting, an inheritance from stone-mason work, was once universal, and is still an accepted method. Its difficulties and deficiencies are well known. Complete non-shrinking filling under a large shoe is not always attained. The shoe must generally be supported on steel wedges before and during filling. These wedges may have to be substantial if considerable load is to be supported until the mortar is placed and set. Leveling observations may have to be conducted hurriedly to avoid wasting the time of a whole erection crew, and such haste may lead to errors. Also, because of the presence of steel work and erection crew, the space for setting up a level may be cramped and awkward.

Removal of shoes that were pressure grouted or had mortar rammed under them, has disclosed voids and incomplete contact. Also, thin layers of mortar do not always have the compressive strength of thick slabs of concrete. Inspection of some old bridges has disclosed such extensive deterioration of mortar filling that the shoes were supported almost wholly on the original steel wedges or shims.

The plan of finishing the concrete high and then dressing down the shoe area by chipping or grinding has become a popular alternative. Perfectly done, this method provides assurance of contact under the shoe for its full area. A wash of cement mortar, a liberal daubing of red lead, or a thin lead sheet is sometimes used to compensate for minor roughness. The shoe seat can be prepared well in advance of steel erection, and leveling can be done without interference with it. But such chipping or grinding is precise work, and the engineer must be in almost constant attendance. Even then, perfection is hard to attain and correction is difficult.

Embedded grillages of steel beams have long been used for particularly large and heavy loads and offer many advantages, but are unnecessarily elaborate for most conditions.

A method of shoe setting devised and perfected through the years by Howard, Needles, Tammen & Bergendoff offers certain advantages. The top of the pier is finished an inch or two low, below the elevation for the bottom of the steel shoe. This affords drainage away from the shoe. Under each shoe a pit or pocket is formed in the concrete about 10 to 12 in. wider and longer than the steel shoe and 15 to 18 in. deep, providing for a concrete pad. See Fig. 1. Anchor bolts are set in place and embedded in the concrete, penetrating at least 18 in. below the bottom of the pad pocket and projecting the required height above the top of the pier. At least four anchor bolts are threaded from their tops down to some 8 in. below the bottom of the shoe. Good triangulation work will assure accurate bolt setting. The instrumental error even for very large triangulation systems is easily less than the tolerance allowed in anchor-bolt holes in shoes.

For each shoe a steel frame is provided which, for identification, we term a "screed-template frame." This is made of wide-flanged angles, usually cut from channels. The frame, made by welding with mitered corners, is about 6 in. wider and longer than the shoe. Accurately located holes are provided for the anchor bolts. Frames are made perfectly flat on top, by machining if necessary.

These frames serve well as top templates for setting the anchor bolts. They can be supported by wood or metal struts across the top of the form for the last lift of concrete, and the anchor bolts can be suspended from them, stayed by a suitable bottom template. At times it is convenient to set the frame first at the tops of the bolts, shifting it down later. On the four long threaded bolts, nuts are provided both below and above the screed-template frame.

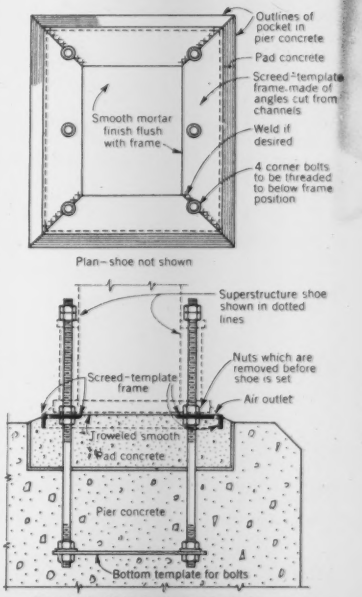
After the concrete of the pier has thoroughly cured, and at times convenient to the field engineer, the screed frames are adjusted to exact elevations by turning the place nuts above and below, and once set, are firmly fixed. The pits below the screed-template frames are then filled with concrete of a dense mix of non-shrinking character, forming a special concrete pad to support the shoe. This is troweled and finished with a steel straightedge so as to provide a perfectly smooth concrete surface which is exactly even with the top of the frame.

An apparently perfect surface can be secured in this way more easily than by grinding. A special mortar topping such as "Emeri-Crete" has at times been used.

The projection of the frame beyond the limits of the shoe makes welding of the shoe to the frame quite simple where it is desired to transmit shears to the masonry. Angles rather than channels are used for the frames to assure, by tamping and vibration, complete contact of the pad concrete with the under side of the frame. Air relief holes at the roots of the angles facilitate complete filling. The adjustment of frame height and deposit of pad concrete is deferred until after the main body of the pier has reached full shrinkage.

These operations can be completed well in advance of the approach of the steel gang. The threaded nuts permit perfect setting to elevation. The upper nuts are, of course, removed before the shoe is set in place. This detail has been found to serve well even for rather small shoes and is most satisfactory for large ones.

FIG. 1. SCREED-TEMPLATE FRAME set to exact elevation acts as screed to finish top of concrete pad and solves problem of seating shoe of steel bridge superstructure on concrete substructure.


Outlines of pocket in pier concrete
Pad concrete
Screed-template frame made of angles cut from channels
Smooth mortar finish flush with frame
Weld if desired
4 corner bolts to be threaded to below frame position
Plan—shoe not shown
Superstructure shoe shown in dotted lines
Nuts which are removed before shoe is set
Screed-template frame
Air outlet
Troweled smooth pad concrete
Pier concrete
Bottom template for bolts
Cross section through corner anchor bolts

Charts determine stresses in truss members for H-S loading

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TO FIND the stress in a truss member under H-S loading by present procedures, it is necessary to sketch the influence line, determine the position of the H-S standard truck for maximum effect, and solve for the stress in the member. In addition, the stress in the member due to lane loading must be found. The larger of the two values thus determined is the final stress in the member.

To simplify this procedure, the writer recently prepared two charts (Figs. 1 and 2) for use in designing highway bridges under the AASHO Specifications. These charts save considerable time in determining stresses, shears, moments, or reactions under H-S loading. One chart is used for a moment function and the other for a shear function, inasmuch as the lane loadings for these two cases are different. The charts can be used for any function if it has a triangular influence line, or if that part of the influence line to be loaded is a triangle. This includes the stresses in members of simple trusses, shear and moment at any point of a simple beam or girder, and reactions for simple structures.

To determine the value of a function as caused by H-S loading, simply enter the proper chart using the lengths of the two segments of the influence line. Read off the value from the curves, interpolating by eye between the plotted values. This value is then multiplied by h, the influence-line ordinate due to a load of 1 kip. The result is the value of the function due to the H20-S16-44 loading.

The charts take into consideration Spec. 3.2.8(d) of the AASHO Standard Specifications for Highway

FIG. 1. Curve for a MOMENT FUNCTION gives stress in truss member for H-S loading in two steps: (1) chart is entered with two segments of influence line to obtain stress value; (2) stress value is multiplied by h, influence-line ordinate due to load of 1 kip, to find value of moment function due to H-20-S16-44 loading. For H-15-S12-44 loading, multiply by 75 percent.

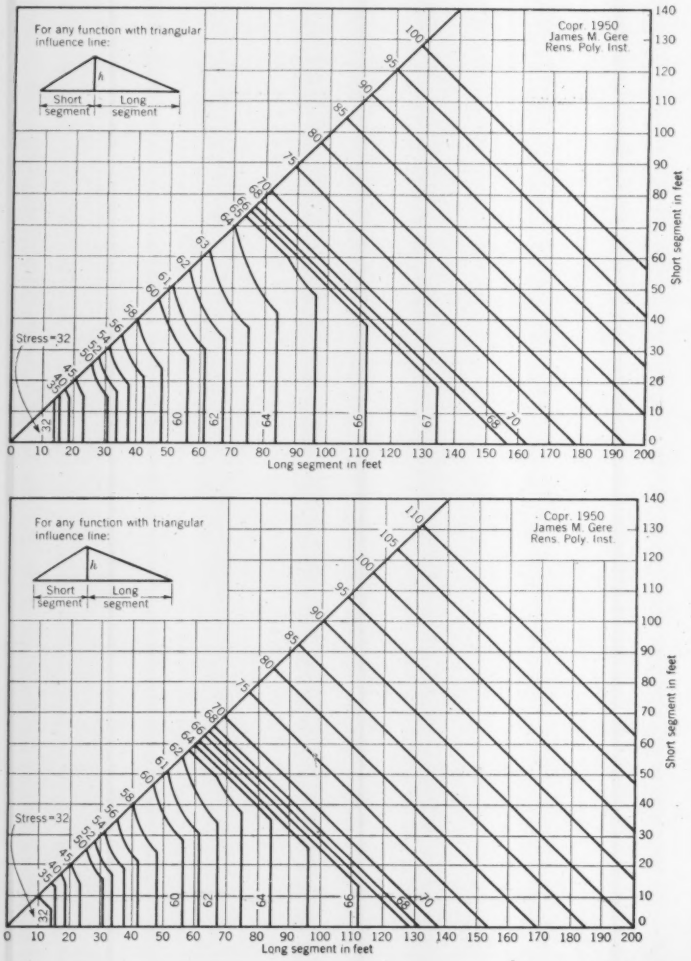
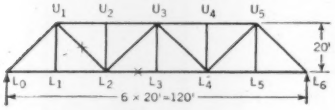


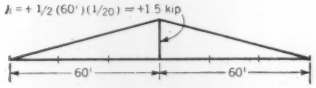
FIG. 2. Curve for a SHEAR FUNCTION gives stress for H-S loading in same manner as for a moment function in Fig. 1.

Bridges, which states that either truck or lane loading is to be used, whichever produces the larger stress. The value obtained from the charts is the larger of either truck or lane loading. For an H15-S12-44 loading, multiply the value for the H20-S16-44 loading by 75 percent.

The following Warren truss illustrates the procedure. Suppose it is desired to find the live-load stresses in the bottom chord member L_2L_3 and the web member U_1L_2, using H20-S16-44 loading. Assume a two-lane bridge, so that each truss carries one lane of traffic. (If the truss carried more than one lane, say $1^1/_2$ lanes of traffic, then the results would be multiplied by $1^1/_2$).



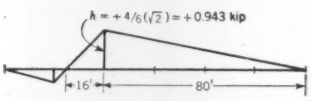
The influence line for L_2L_3 is:



Entering the chart for a moment function (Fig. 1), and using a short segment of 60 ft, and a long segment of 60 ft, the value read from the chart is 62.6. Multiply by h, the influence-line ordinate, to obtain the stress in L_2L_3.

$L_2L_3 = 62.6 \times 1.5 = +93.9$ kips (tension)

The influence line for U_1L_2 is:



Entering the chart for a shear function (Fig. 2), and using a short segment of 16 ft and a long segment of 80 ft, the value read from the chart is 63.6. Multiply by h, the influence-line ordinate, to obtain the stress in U_1L_2:

$U_1L_2 = 63.6 \times 0.942 = +60.0$ kips (tension)

Mimeographed charts may be obtained from the writer on request.

Design method for eccentrically loaded steel columns fits any code

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A METHOD for designing eccentrically loaded structural steel columns has been developed by the writers to provide a single, simple, fast procedure applicable to any code requirement. This method, here presented, is based on the assumption that an eccentrically loaded column, whose slenderness ratio falls within the required limits, will give satisfactory service if the combined compressive unit stresses from all sources at any point in the column do not exceed the allowable maximum permitted for ordinary flexure. The basic equation which follows is derived from Fig. 1, which shows a section of an eccentrically loaded wide-flange column.

$$s_{max} = \frac{P_e}{A} + s_a' + \frac{M_x}{S_x} + \frac{M_y}{S_y} \quad . \quad (1)$$

where

s_{max} = maximum allowable unit stress permitted for ordinary flexure
P_e = eccentric load applied at top of column
A = cross-sectional area of column
s_a' = accidental bending stress caused by variations from ideal conditions
M_x, M_y = resultant moments about principal axes
S_x, S_y = section moduli about respective axes X-X and Y-Y

For an axially loaded column supporting the maximum load P_c, permitted for its L/r by the code in use, the accidental bending stress is assumed to be

$$s_a = s_{max} - \frac{P_c}{A} \quad . \quad . \quad . \quad . \quad (2)$$

and then, assuming that the accidental bending stress in a column with any load, P_e, is proportional to the load,

$$s_a' = \left(s_{max} - \frac{P_c}{A}\right)\frac{P_e}{P_c} = s_{max}\frac{P_e}{P_c} - \frac{P_e}{A} \quad (3)$$

Substituting Eq. 3 in Eq. 1,

$$s_{max} = s_{max}\frac{P_e}{P_c} + \frac{M_x}{S_x} + \frac{M_y}{S_y} \quad . \quad (4)$$

Next, multiplying the terms on the right side of Eq. 4 by A/A,

$$s_{max} = s_{max}\frac{P_e}{P_c(A/A)} + \frac{M_xA}{S_xA} + \frac{M_yA}{S_yA} \quad . \quad (5)$$

Now let $P_c/A = s_c$, which is the usual expression by the code in use for the permissible average stress on an axially loaded column,

$$\frac{A}{S_x} = B_x \text{ and } \frac{A}{S_y} = B_y$$

and substitute these symbols in Eq. 5. (Quantities B_x and B_y are called "bending factors." See *Steel*

Construction, Manual of the American Institute of Steel Construction, 1947, pp. 207–221.) Then

$$s_{max} = \frac{P_e\left(\frac{s_{max}}{s_c}\right) + M_x B_x + M_y B_y}{A} = \frac{P'}{A} \quad \ldots\ldots (6)$$

or

$$\text{Required } A = \frac{P_e\left(\frac{s_{max}}{s_c}\right) + M_x B_x + M_y B_y}{s_{max}} = \frac{P'}{s_{max}} \quad (7)$$

P' in Eqs. 6 and 7 is called the equivalent axial load and, as indicated, it is composed of three quantities. The first reflects the effect of the axial load and accidental bending and the others reflect the effects of known bending about the principal axes.

It should be noted that, for values of $(Ld/bt) \leq 600$ (see p. 286 of AISC Manual referred to above), Eqs. 6 and 7, which are applicable to any code, reduce to the non-dimensional expression for eccentrically loaded column analysis given on page 208 of the same manual. The authors feel that it is safe to use these equations for values of $(Ld/bt) > 600$ because they believe that the allowance for accidental stress given by Eqs. 2 and 3 is adequate to take care of any additional compressive stress caused, in the case of a rolled beam, by lateral buckling of its more highly stressed flange. It should also be noted that, when the moments of M_x and M_y are equal to zero, Eq. 7 reduces to the familiar form for designing an axially loaded column.

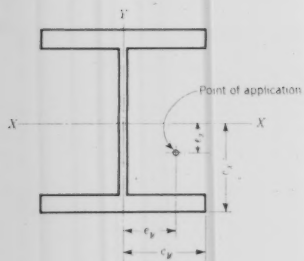


FIG. 1. SECTION of eccentrically loaded wide-flange column shows derivation of basic equation, Eq. 1.

The first step in the design procedure is to assume a trial value for s_c or a trial value of (s_{max}/s_c). For usual column lengths and loads it is satisfactory to use, as a trial, a value of s_c about midway between the maximum and the minimum permissible working stresses; or a value of (s_{max}/s_c) equal to about 1.5 because it has been found that this ratio varies between 1 and 2 for the usual design ranges of L/r. (A convenient table can be made of values of (s_{max}/s_c) for values of L/r varying at intervals of 10 for codes in common use.) Next assume values for the bending factors; average values that can be used for a first trial are $B_x = 0.2$ and $B_y = 0.7$. Then compute the equivalent axial load and an approximate required area by Eq. 7. This area is used to select a first trial section. The shape, which is selected after noting all shapes having approximately the required area, should be that one of the noted group which has the largest least radius of gyration and also the smallest bending factors, but the latter is not absolutely essential.

The actual s_c and the actual bending factors of the trial shape are substituted in Eq. 7 to obtain a new required area. If the furnished area is equal to or greater than this required area, the trial section is satisfactory but not necessarily the most economical. In case the furnished area is less than the required area, a second trial shape is chosen using the section constants of the first trial as a guide. After an apparently economical shape has been found, beams of shallower and deeper nominal depths should be examined for possible lighter sections.

Illustrative Problem

A column which is 12 ft long and laterally supported only at its ends carries an axial load of 300 kips and an eccentric load of 50 kips, applied as shown in Fig. 1, with $e_x = 18$ in. and $e_y = 0$. Select the lightest wide-flange section using the working stresses from the AISC (1946) Specifications for Steel Buildings. (Note that this is essentially the same problem as that given on p. 207 of the AISC Manual previously referred to.) The solution is given in Table I.

Possible trial sections:

Sections	A	Least r	B_x
12 WF 120	35.31	3.13	0.216
14 WF 119	34.99	3.75	0.185
18 WF 114	33.51	2.76	0.152

The 14 WF 119 is selected as a first trial because it has the largest least radius of gyration.

$$\frac{L}{r} = \frac{12 \times 12}{3.75} = 38.4 \therefore s_c = 16.28$$

$$P' = 350 \times \frac{20}{16.28} + 900 \times 0.185 = 430 + 167 = 597$$

$$\text{Required } A = \frac{597}{20} = 29.85$$

Although the 14 WF 119 is satisfactory, a check is made for lighter sections. Possible sections:

Sections	A	Least r	B_x
10 WF 112	32.92	2.67	0.261
12 WF 106	31.19	3.11	0.216
14 WF 103	30.26	3.72	0.185
18 WF 105	30.86	2.73	0.153

It is obvious from this tabulation and from the computations for the 14 WF 119 that the 14 WF 103 is the lightest section that should be used for the given loading.

TABLE I. SOLUTION OF ILLUSTRATIVE PROBLEM

Assuming an Average s_c (ksi = kips per sq in.)	Assuming $\left(\frac{s_{max}}{s_c}\right) = 1.5$
$s_{max} = 20$ ksi	
Max $s_c = 17$ ksi	
$s_c = 10$ ksi for $L/r = 120$	
Average $s_c = 13.5$ ksi	
$P_e = 300 + 50 = 350$ kips	$P_e = 350$ kips
$M_x = 50 \times 18 = 900$ in.-kips	$M_x = 900$ in.-kips
$P' = 350 \times \frac{20}{13.5} + 900 \times 0.2 = 698$ kips	$P' = 350 \times 1.5 + 900 \times 0.2 = 705$ kips
Required $A = \frac{698}{20} = 34.9$ sq in.	Required $A = \frac{705}{20} = 35.2$ sq in.
Least $r = \frac{12 \times 12}{120} = 1.2$	Least $r = 1.2$

THE READERS WRITE

Only Cooperative Action Will Assure Desired Changes in CSC Classifications

TO THE EDITOR: In the letter to the editor, "Reclassification of Engineers in Government Service Considered Vital to Defense Effort" (October 1951, p. 48), Mr. Pekor presents a justifiable criticism of the present policy of the U.S. Civil Service Commission in classifying professional engineers. This policy is not alone vital to the defense effort; it is vital to all professional employees in the Government service and to all Government agencies employing professional personnel. The general method of examining, grading and classifying, as at present followed by the Commission, of applicants for appointment to professional grades above GS-5 (formerly designated as P-1) is especially open to criticism and most certainly is in need of revision.

The possible solutions suggested by Mr. Pekor warrant careful consideration by the engineering profession. A return to written examinations as a qualifying prerequisite for appointment or promotion to the first three professional grades, GS-5, GS-7 and GS-9 (P-1, P-2, and P-3), would be desirable and worth while. For appointment to the higher grades, the applicant should possess the qualifications required for professional registration. Evidence of qualification wholly based on the statements submitted by the applicant on Form 57 should not be acceptable unless substantiated by a certificate of registration obtained by passing a written examination, or successful completion of a similar examination conducted by the Civil Service Commission.

Existing civil service laws are sufficiently broad to permit the Civil Service Commission to make the desirable changes in its present policies. However, such action need not be expected until conclusive evidence is presented to the Commission that the engineering profession insists on higher classification standards. If the members of the several branches of the engineering profession want these higher standards put into effect, they should bring the problem to the attention of the governing boards of the Founder Societies and other professional groups. These governing boards, both directly and through the Engineers Joint Council, the Inter-Society Cooperative Committee, the Engineers' Council for Professional Development, the several state boards of registration, and other joint-action groups, can and should present the desirable changes in the present and long-time policy to the Civil Service Commission for appropriate action. This is the one sure way to secure the desired changes.

D. M. FORESTER, M. ASCE
Billings, Mont.

P-1 Exam Rated as Poor Method of Selecting Engineers for Higher Grades

TO THE EDITOR: I have read with interest Mr. Pekor's letter to the editor on reclassification of engineers in government service, in the October issue.

With much of what he says, no one familiar with government service can reasonably disagree. But as to the practicability of the recommended examining procedure there is valid basis for doubt. Mr. Pekor says: "Certainly it would not be too difficult to administer the current P-1 examination as a prerequisite for appointment or promotion to any of the first three professional grades." Actually, a P-1 examination is designed as a test of a college graduate's knowledge of the fundamentals of the courses he has just completed, and it has proved reasonably successful in selecting such men for initial employment.

But what about its use in selecting men for grades P-2 and P-3? Bear in mind that it is largely a memory test. Applicants for P-2 positions usually have been at work for from 2 to 5 years before they attempt to qualify for this grade, and applicants for P-3, from 3 to 10 years. In this period two things have happened —they have forgotten most of what they learned in college and they have discovered that progress in the profession depends on many things besides proficiency in the use of technical knowledge.

The P-1 examination as a basis for selecting engineers begins to break down at the P-2 level. Good P-2 men may fail it entirely. P-3 men usually will fail—too far away from their textbooks! Most men in the higher grades would fail it not because they are untrained but because, as the years have passed, their attention has been given to other matters—usually to problems which, while involving an expert knowledge of some phase of engineering, also require the use of judgment based on many other considerations.

And right here is the one problem the advocates of examinations as a basis for promotions must meet and solve if any success is to attend their efforts—the problem of determining just what is a specialist, or what is wanted when an engineer who has gone far enough in his field (P-4 and up) to become a specialist, is employed. Evidently a good knowledge of the particular field is important, but many other things often are vastly more important, such as personality, the ability to make friends and influence people, judgment and integrity. And so far at least, no generally accepted method of evaluating these qualifications has ever been developed. Moreover, until it is, the selection of men for the higher professional positions on the basis of the grades they attain in an examination would be no more accurate than selecting them on the basis of the measurements of their hat bands or the length of their arms.

Admittedly errors are made under the present system of selection on the basis of administrative judgment. But this also is the basis used in the business world, where errors also are made. In both fields executives would welcome a better system. But none has ever been developed and it seems most doubtful that one ever will be, at least for many years. Examining the amount of a man's professional knowledge does not give the right answer—not even a useful answer—and never will.

J. L. HARRISON, *Ass't. Chief, Inter-American Regional Office, Bureau of Public Roads*
Washington, D.C.

Congratulations to City Planning Division

TO THE EDITOR: I wish to congratulate the City Planning Division of the Society upon the success of its October 25th session held during the 1951 Annual Convention.

It is to be noted that some 2,850 members of the Society have enrolled in the City Planning Division, and it is hoped that the meeting of October 25, together with others of the same type, will serve to dispel the apprehension and distrust apparently held in some quarters concerning what I have seen described as "the always ticklish question of the relation between city planning and engineering."

WILLIAM J. SHEA, M. ASCE
New York, N.Y.

Engineer's Role Should Be Publicized

TO THE EDITOR: With great interest my friends and I read President Hathaway's article, "Membership Trends Influence Society Responsibilities," in the July issue. In it he deplores the fact that engineers are a relatively underpaid group while becoming increasingly important and numerous in the nation's society and economy, and states that the Society "has not assumed aggressive leadership in formulating and implementing policies for improving the economic status of engineers."

The article does not go into detail as to how this "aggressive leadership" should be carried out and what it should consist of. But it seems to me that perhaps one reason for the engineer's low compensation is the public's woeful ignorance of his functions and extensive activities. It is unfortunately not amusing that most laymen, hearing the word "engineer," think first of a locomotive driver. Speaking of our own profession, I have yet to find a lay person who has anything but the haziest notion of what a civil engineer does, outside (perhaps) of a faint recollection that he's the fellow who builds bridges. In short, most of the public have no clear idea of how important the engineer is to modern society, a very sad situation if it is indeed true that in 1940 there was one engineer for every 78 workers.

The question is, of course, how engineers can make themselves better known, and this is where the various engineering societies can help. President Hathaway speaks of the "dignified, professional manner." Perhaps there has been a little too much dignity within the professional societies as regards public relations, and almost an unwillingness to get engineers heard and read about by the public.

When the American Medical Association feels that it has a story to tell to the people, it does not hesitate to do so through the newspapers of the nation. Could not the engineering societies do the same? They could certainly attempt to have the newspapers publish more stories and feature articles in which the engineer's role is made clear. They could encourage the writing of books which would do the same thing. There have been best-selling novels in which the central characters were doctors, lawyers, and clergymen, but how many have featured engineers and their work? Radio, television, movies—all could be used to make the engineer better known, without endangering the dignity of the profession or that of the professional societies.

Until engineering is recognized by the American public as a profession—and I believe that this is not now the case—engineers (certainly those in government service) cannot hope to be looked upon, or recompensed as, among the most important workers in our society.

ERNEST NUSSBAUM, Jun. M. ASCE
Elmira, N.Y.

Another Junior Elected at Age of Nineteen

TO THE EDITOR: The writer was interested in the letter in the November issue from Theodore Belzner, Affiliate ASCE, regarding his election as a Junior in the Society on October 5, 1897, at the age of 19. It is noted that he believes himself to be "one of youngest—if not the youngest—Junior ever admitted."

Mr. Belzner was probably the first to attain Junior membership at the age of 19. However the writer wishes to advise that on November 12, 1928, he also was admitted to the Society as a Junior at the age of 19, having previously become a member of the California Student Chapter at the University of California at the age of 15.

The writer has since been privileged to attain the grade of Associate Member in 1942, and that of Member in 1944 at the age of 35, to comply with membership requirements.

It is hoped that the technical growth attained by the Society and by its individual membership over the years, in contributing to the physical well-being of mankind, will some day be matched by our ability to use these various physical benefits in peaceful and unselfish pursuits.

GLENN L. ENKE, M. ASCE
Salt Lake City, Utah

Formulas Suggested for Various Weir Conditions

TO THE EDITOR: With reference to the weir formulas given by Charles Grant Edson in his article, "Nomograph Provides Method for Comparison of Weir Formulas," in the August issue, the writer suggests that no single formula is applicable to all conditions of height of weir and head on weir and suggests the following formulas:

Let $Q = Cbh^{1.5}$ = cu ft per sec
where b = length of weir crest in ft
z = height of weir crest above bed, in ft
h = head on weir in ft

For $h = 0.04$ to 0.5 ft,

$$C = 3.30 + \frac{0.015}{h} \quad . \quad . \quad . \quad (1)$$

For $h = 0.5$ to 1 ft,

$$C = 3.32 + \frac{0.015}{h} \quad . \quad . \quad . \quad (2)$$

For $h > 1$ ft,

$$C = 3.21 + 0.13h \quad . \quad . \quad . \quad (3)$$

$$C = 3.20 + 0.12h + h\left(\frac{1}{z+1}\right)^2 + 1.5h\left(\frac{1}{z+1}\right)^4 + \frac{0.015}{h} \quad . \quad . \quad (4)$$

The formula giving the largest coefficient should be used.

Equation 4 gives $Q = 1.627$ for $z = 1$, $h = 0.6$, which agrees somewhat closely with the Rehboch formula.

The formulas here presented are based on data given by Ernest W. Schoder and Kenneth B. Turner, in their paper on "Precise Weir Measurements" in the TRANSACTIONS of ASCE, Vol. 93 (1929), and give results in close agreement with the experiments there recorded.

N. F. HOPKINS, M. ASCE
Pittsburgh, Pa. *Hopkins & Stotler*

SOCIETY NEWS

PEACE ON EARTH ★ GOOD WILL TOWARD MEN

Edward C. Dohm Becomes Director for District 12

As announced in the November issue, Gen. Edward C. Dohm, of Olympia, Wash., was appointed ASCE Director for District 12 at the October meeting of the Board of Direction. He succeeds the late Walter J. Ryan and will serve out his unexpired term.

A graduate of the University of Washington, General Dohm has combined an engineering and military career. Starting as an assistant in the State Department of Public Lands, he became chief engineer in 1913—a position he held for twenty years, together with that of state supervising engineer on the Seattle Harbor Project. From 1933 to 1941, he was commissioner of public works for the City of Olympia, and from 1944 to 1947 special engineer for the city on the design of a new sewer system. Since 1947 he has been secretary of the State Department of Licenses and of all professional boards, including Engineers and Architects. He has been a member and secretary of the State Board of Engineering Examiners since its inception in 1935, and for many years was consulting engineer for the Port of Olympia. At present he is secretary of the Olympia Planning Commission and the DesChutes Basin Joint Advisory Committee.

Joining the National Guard in 1904, he was connected with the military service in some capacity until his retirement in 1947 with the rank of brigadier general. He served in France as a captain, 29th Engineers, and organized and commanded the 248th Coast Artillery in 1919 and the 205th Coast Artillery in 1939, taking the latter regiment into service in February 1941.

A corporate member of ASCE since 1914, General Dohm has served the Tacoma Section in many capacities including the presidency.

EDWARD C. DOHM
Director, District 12

New Orleans Plans Outstanding Convention Program

Engineers and their families going to New Orleans for the ASCE Spring Convention, March 5–7, 1952, are assured a program of outstanding technical, social, and historic interest. With the Convention the first to be held in the ASCE Centennial year, the program will include special features celebrating the occasion. Headquarters for the Convention will be the St. Charles Hotel, located in the commercial center of the city.

Technical sessions of both national and regional concern are being planned by all but one or two of the Society's fourteen Technical Divisions. In the former category there will be a general session devoted to engineers' activities in the Civil Defense Program. Several of the Divisions are sponsoring tours of engineering projects under way—expressways, sanitary facilities, and new industrial plants—for the civic betterment and commercial expansion of the city.

In contrast to modern projects and improvements, the famous "French Quarter" of the old city, noted the world over for its historic interest, its picturesqueness and its fine restaurants, remains unchanged. Special plans are being made for the visiting ladies by the committees in charge. All will find much to see and do in this sightseeing center, which is at its loveliest in the early spring.

Engineering colleges throughout the South are planning to send delegates to a Student Chapter Conference to be held during the New Orleans Convention. In addition, Faculty Advisers will be brought together in the Convention city for the first of a series of new-type conferences. Of primary concern to both conferences will be the integration of young engineers into the profession with news of new programs to expand the work of ASCE in this field. Participation of students in other Convention events is also planned.

To allow plenty of time for planning trips to the New Orleans Convention the complete program of all events will be printed in the January issue of CIVIL ENGINEERING. General Convention chairman David W. Godat urges that reservations be made early in view of the probable large attendance and a limit to rooms in the headquarters hotel. For those who must delay making plans, arrangements will be made later for accommodations in hotels near the St. Charles.

An added inducement to attendance is the special half-fare travel rate being offered by airlines for family travel during the early part of the week.

ASCE Yearbook for 1952 Must Be Requested

As announced in previous issues, the new Yearbook membership list, which is being processed for publication in January 1952, will be mailed only to members specifically requesting it. In the interests of economy and in line with the practice of other technical societies, the size of the edition will be determined by the number of requests received. To simplify ordering, a coupon is provided on page 82.

Copies will be distributed automatically to officers of the Society and to Local Sections.

Deterioration of Society Headquarters Building Discussed in Annual Report of U.E.T.

Serious deterioration of the Engineering Societies Building is presented as a prime problem facing the societies in the 1950–1951 report of United Engineering Trustees, Inc., the body that owns and operates the building and the Engineering Societies Library.

Pointing out that the building has been in use for 44 years by the Founder Societies and their associates, the report notes that during the past year the steam lines have required some overhauling, which is a warning that extensive piping may be necessary at any time. Tests required by the city on the elevator safety controls have developed the necessity for a new type of controls. "This expenditure now is unfortunate," the report states, "as we had hoped to defer any major renewal at least until the possibility of acquiring a new headquarters building for all the engineering societies can be explored." Although frequent local repairs are being made each year on the windows, it merely postpones the complete refenestration that will be necessary.

Emphasizing its hope that there will be some way to acquire a new building that will house not only the Founder Societies and their present associates, but include all the engineering societies, the report comments that this would make a "real engineering center as was Andrew Carnegie's ideal when he gave the present Engineering Societies Building to 'the engineering profession of America.' The several possibilities for obtaining a new building which have been investigated have not yet materialized, but we are keeping conversations open."

All available office space in the building is occupied and paying its share of operating costs, according to the report. Expansion of the societies and the need to find suitable office space for such new groups as the Engineering Manpower Commission of Engineers Joint Council have necessitated considerable shifting about and doubling up. "We have about exhausted all these makeshift expedients, however," the report notes, "and believe that a new building is the only answer to the needs of the societies. We continue to receive applications for the purchase of the property."

To meet replacement costs from a fire insurance standpoint, in the face of rising costs, $1,904,000 insurance is now carried on the building above the foundations. The city assessed valuation is $430,000 on the land and $505,000 on the building, all tax exempt.

"These same rising costs," the report continues, "have again manifested themselves in the necessity for higher wages for the building service staff this year, in line with awards made to union employees in Manhattan buildings. In addition, with the revision of the Social Security laws to cover organizations such as ours, the employees voted to be included."

The building depreciation reserve is held to be of growing importance because of the increased necessity for a new engineering center. At the close of the fiscal year it amounted to $821,708.88, which after 47 years does not yet equal the original Carnegie gift. However, no deductions have been made from the reserve for several years so that it is growing at an appreciable rate. Each year $20,000 is added from building income, and interest from investments added another $54,923.23 for the past year.

United Engineering Trustees, Inc., was incorporated in 1904 "to act for the associated societies in the advancement of the engineering arts and sciences in all their branches and to maintain a free public engineering library." Present ASCE representation of the body consists of George W. Burpee, William N. Carey, and Waldo G. Bowman. The term of Irving V. A. Huie, M. ASCE, who has been president and chairman of the executive committee, has just expired. President for the 1951–1952 fiscal year will be R. F. Gagg.

Henry T. Heald Appointed to Centennial Committee

Appointment of Henry T. Heald, M. ASCE, newly elected chancellor of New York University, to the chairmanship of the Centennial Convocation Committee is announced. President of the Illinois Institute of Technology in Chicago since 1940, Dr. Heald will assume the chancellorship of New York University early next year.

ASCE members desiring to make room reservations in advance for the period of the Centennial Convocation, September 3-13, 1952, are urged to write to the Conrad Hilton Hotel (formerly the Stevens), Chicago, Ill., noting that the request is in connection with attendance at the Convocation. Other societies planning to have their headquarters at the Conrad Hilton include the American Concrete Institute, the American Institute of Consulting Engineers, the Engineers Council for Professional Development, the National Council of State Boards of Engineering Examiners, and the Society of American Military Engineers. The Palmer House will be headquarters for the American Institute of Chemical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Iron and Steel Institute, and the American Railway Engineering Association. Convening at the Sherman will be the American Society for Testing Materials, the Institute of Traffic Engineering, the National Conference on Industrial Hydraulics, and the Society of Naval Architects and Marine Engineers. The American Institute of Electrical Engineers will have its headquarters at the Congress, and the American Society of Mechanical Engineers at the Sheraton.

Henry T. Heald

An Information Circular summarizing Centennial program data has been prepared at ASCE headquarters for the benefit of members. The pamphlet is being sent to all Local Sections, the Board of Direction, and the secretaries of the participating societies.

Daniel W. Mead Prize Subjects Are Announced

This year's contestants for the Daniel W. Mead Prizes for Junior and Student Chapter members will write on different subjects, according to an announcement of the ASCE Committee on Professional Conduct. Junior Members will discuss Clause 8 of the Code of Ethics, reading "It shall be considered unprofessional to use the advantages of a salaried position to compete unfairly with engineers in private practice." The student topic is, "My concept of engineering as a profession in contrast with it merely as a job." All entries must reach the Executive Secretary of ASCE by June 1, 1952.

Established in 1939 by the late Daniel W. Mead, Past-President and Honorary Member of the Society, the Daniel W. Mead Awards consist of a Junior Member prize of $50 in cash and a certificate and a Student Chapter prize of $25 and a certificate.

William L. Batt Receives Hoover Medal for 1951

Award of the Hoover Medal for 1951 to William L. Batt, a mechanical engineer, for "distinguished public service" is announced by the award board representing the four Founder Societies. Formerly president of SKF Industries, Philadelphia, Mr. Batt is now minister in charge of the Economic Cooperation Administration to the United Kingdom, with headquarters in London. He is cited as a "Leader in engineering, management, and public responsibilities who has, through many distinguished services to his community and the nation, merited the Hoover Medal for 1951."

Presentation of the medal was made to Mr. Batt at an Honors Luncheon held during the annual meeting of the American Society of Mechanical Engineers in Atlantic City the last week in November. He is the thirteenth engineer to receive the medal since it was first awarded to Herbert Hoover in 1930 to commemorate his civic and humanitarian achievements.

Recent recipients of the Hoover Medal include ASCE Past-President Malcolm Pirnie, Vannevar Bush, Ralph Flanders, and Frank Baldwin Jewett.

Convocation Discusses Engineering Shortage

Four talks stressing the need for public recognition of the lack of engineering manpower highlighted the engineering manpower convocation held in Pittsburgh on September 28 under sponsorship of the Engineering Manpower Commission of Engineers Joint Council in cooperation with the Engineers Society of Western Pennsylvania.

In the opening speech, A. C. Montieth, vice-president of Westinghouse Electric Corp., pointed out that "in order to maintain and advance our standard of living, more engineers and more scientifically trained men must be available." The educational phases of the discussions were covered by S. C. Hollister, dean of Cornell University, who urged industry to encourage new college enrollments.

M. H. Trytten, of the National Research Council, Washington, D. C., warned the military against misplacing engineering personnel in the various services. Carey H. Brown, chairman of the Engineering Manpower Commission and manager of Engineering and Manufacturing Services of Eastman Kodak Co., emphasized the engineers' role in coping with the shortage and asserted that "to properly play his part, each individual engineer must so devote himself to his own task that the total engineering output shall not suffer by his deficiency."

The attendance of over 400 included engineers, educators, and industrialists from all over the country.

ATTENDING Engineering Manpower Convocation are (left to right) A. C. Monteith; G. A. Shoemaker, vice-president Pittsburgh Consolidated Coal Co.; Carey H. Brown; and T. A. Marshall, executive secretary of EMC.

Board Confirms 1952 Committee Personnel

The Board of Direction, at its meetings during the Annual Convention in New York in October, confirmed appointment of ASCE committees for the coming year, the committee personnel to take office on January 16, 1952. The committees of the Board are as follows:

Executive Committee: C. S. Proctor, Chairman; D. V. Terrell, Vice-Chairman; G. A. Hathaway, E. E. Howard, W. R. Glidden, G. W. Burpee, and A M Rawn.

Honorary Membership: C. S. Proctor, Chairman; D. V. Terrell, Vice-Chairman; G. A. Hathaway, E. E. Howard, W. R. Glidden, G. W. Burpee, and A M Rawn.

Districts and Zones: D. V. Terrell, Chairman; G. W. Burpee, Vice-Chairman; W. R. Glidden, and A M Rawn.

Professional Conduct: Morris Goodkind, Chairman; George W. Lamb, F. L. Weaver, W. L. Chadwick, and J. A. Higgs.

Publications: L. R. Howson, Chairman; F. S. Friel, Vice-Chairman; Otto Holden, N. R. Moore, F. A. Marston, and I. C. Steele.

Membership Qualifications: M. T. Wilson, Chairman; B. G. Dwyre, Vice-Chairman; G. W. Lamb, W. L. Chadwick, W. D. Binger, and G. W. McAlpin.

Division Activities: D. V. Terrell, Chairman; F. W. Burpee, Vice-Chairman; Gordon Butler, Kirby Smith, and A. E. Cummings, and L. R. Howson, ex-officio.

Meetings: D. V. Terrell, Chairman; W. R. Glidden, Vice-Chairman; G. W. Burpee, and A M Rawn.

Coordination of Professional Activities: F. A. Marston (Eng. Education); Edward C. Dohm (Registration); I. C. Steele (Emply. Conditions); G. B. Earnest (Student Chapters); M. T. Wilson (Junior Members); F. L. Weaver, Chairman (Local Sections); F. S. Friel (Private Eng. Practice); and J. A. Higgs (Salaries).

The Auxiliary Administrative Committees* will be:

Local Sections: C. W. Yoder, Chairman (Oct. 1952); John A. Focht, Vice-Chairman (Oct. 1953); Ray L. Derby (Oct. 1954); Craig P. Hazelet (Oct. 1955); and F. L. Weaver, Contact Member (Oct. 1952).

Junior Members: H. F. Thomson, Chairman (Oct. 1952); A. N. Carter, Vice-Chairman (Oct. 1953); T. A. W. Binford (Oct. 1954); George H. Lacy (Oct. 1955); and M. T. Wilson, Contact Member (Oct. 1952).

Student Chapters: D. M. Griffith, Chairman (Oct. 1952); R. H. Dodds, Vice-Chairman (Oct. 1953); G. W. Bradshaw (Oct. 1954); Leo C. Novak (Oct.

* Note: Except for the Board Contact Members of two of these committees, all terms begin Oct. 25, 1951. The two exceptions are in the Application Classification Committee and in the Committee on Retirement. H. L. Blakeslee remains as Contact Member of the Application Classification Committee until January 16, 1952, when W. D. Binger becomes a member of that committee and its Contact Member. Waldo Bowman remains as Contact Member of the Retirement Committee until January 16, 1952, when W. D. Binger becomes a member of the committee and its Contact Member.

WIDE RANGE OF recent Annual Convention activities is caught by camera. Shown here (in usual order, top row and upper right) are speakers at Civil-Military Liaison session—Rear Admiral Joseph F. Jelley, Lt. Gen. Lewis A. Pick, ASCE Past-President Ernest E. Howard (presiding), and Brig. Gen. Colby M. Myers. Snapped at dinner meeting (middle row, left to right) are New Honorary Member Jonathan Jones, Bethlehem, Pa., Past-President Gail A. Hathaway, President Carlton S. Proctor, and Past-President Richard E. Dougherty. In small view at right, Lenox R. Lohr, president of Centennial of Engineering, Inc., addresses Annual Membership Luncheon on centennial program. President Proctor and Past-President Hathaway pose in Puerto Rican "pavas" (left-hand photo) in anticipation of forthcoming Inter-American Convention sponsored by Puerto Rico Section.

1955); C. D. Williams (Oct. 1956); and G. Brooks Earnest, Contact Member (Oct. 1952).

Application Classification: Albert Haertlein, Chairman (Oct. 1952); W. M. Griffin (Oct. 1953); Wm. J. Shea (Oct. 1954); L. G. Holleran (Oct. 1955); and Walter D. Binger, Contact Member (Oct. 1952). Alternates are H. L. Blakeslee and V. T. Boughton (both Oct. 1952).

Securities (All Oct. 1952): R. R. Rumery, Chairman; E. M. Van Norden, G. W. Burpee, and W. D. Binger.

Budget (All Oct. 1952): R. E. Dougherty, Chairman; John W. Cunningham, and Kirby Smith, Contact Member.

Retirement: Walter D. Binger, Contact Member (Oct. 1952); C. E. Beam, Secretary (Oct. 1953); and Wm. J. Shea, Treasurer (Oct. 1955).

National Affairs (All Oct. 1952): F. S. Friel, Chairman; E. E. Howard and C. E. Smith.

The new Professional Committees are:

Engineering Education: Frank Kerekes, Chairman (Oct. 1952); W. S. Evans, Sr. Vice-Chairman (Oct. 1953); A. A. Jakkula (Oct. 1954); P. C. Rutledge (Oct. 1955); and F. A. Marston, Contact Member (Oct. 1952).

Registration of Engineers: T. C. Shedd, Chairman (Oct. 1952); C. L. Eckel, Vice-Chairman (Oct. 1953); C. A. Belden (Oct. 1954); Charles Haydock (Oct. 1955); and E. C. Dohm, Contact Member (Oct. 1952).

Private Engineering Practice: N. T. Veatch, Chairman (Oct. 1955); J. H. Morrison, Vice-Chairman (Oct. 1952); G. J. Requardt (Oct. 1953); H. C. Gee (Oct. 1954); and F. S. Friel, Contact Member (Oct. 1952).

Salaries: R. A. Monroe, Chairman (Oct. 1952); Ray Lawrence, Vice-Chairman (Oct. 1953); H. E. McGee (Oct. 1954); R. J. Ellison (Oct. 1955); and J. A. Higgs, Contact Member (Oct. 1952).[1]

Employment Conditions: R. J. Cummins, Chairman (Oct. 1952); G. I. Teufel, Vice-Chairman (Oct. 1953); E. Robert de Luccia (Oct. 1954); P. M. Wentworth (Oct. 1955); and I. C. Steele, Contact Member (Oct. 1952).[2]

Technical Committee appointees are:

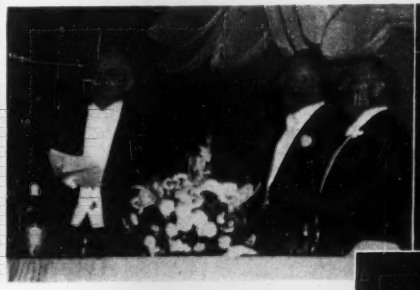
Research: A. E. Cummings, Chairman (Oct. 1952); Shortridge Hardesty (Oct. 1953); H. B. Gotaas (Oct. 1954); E. K. Timby (Oct. 1955); and F. S. Friel, Contact Member (Oct. 1952).

Technical Procedure: All appointments

Notes 1 and 2: Paul Holland, Contact Member until January 16, 1952.

MEN'S SMOKER AND SHOW is one of the most popular features of Annual Convention Program. Seated at table above are (left to right) Kenneth Turner, of Rutgers University staff; Lt. G. H. Obear; Paul P. Rice, of Rutgers civil engineering staff; Brother Austin Barry, of Manhattan College; Joseph C. Thoma, civil engineer, of Washington, D.C.; Charles Knapp, sanitary engineer, the Dorr Co., New York; and Ralph Angell, construction superintendent, Amron Construction Co., New York.

CONVENTION VISITORS include Harold S. Brownlow, of Jamaica, B.W.I. (above).



NEW HONORARY MEMBERS (middle row) are shown in induction ceremonies during annual dinner program. They are Frederick Ohrt, Honolulu, Hawaii (left in left-hand photo); Charles Gilman Hyde, Berkeley, Calif. (between Past-Presidents Howard and Hathaway in center view); and Samuel A. Greeley, Chicago, Ill. (center in right-hand photo). Lower right view shows Arthur T. Ippen, professor of hydraulics at M.I.T. and incoming chairman of newly formed Engineering Mechanics Division of Society (right) with Lorenz G. Straub, director of St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minn.

are ex-officio and terminate in October 1952. The chairman will be the chairman of the Committee on Division Activities. The membership consists of the Committee on Division Activities plus the chairman or alternate from each Technical Division Executive Committee.

The Task Committees follow (all terms begin October 1951 and end October 1952):

Advisory Committee on EJC Water Resources Panel: L. R. Howson, Chairman; W. L. Chadwick, N. R. Moore, I. C. Steele, and G. W. McAlpin.

Awards and Ceremonies: L. R. Howson, Chairman; G. H. Butler, B. G. Dwyre, and W. D. Binger.

George Washington Canal and Locks: A. P. Greensfelder, Chairman; D. C. Walser and F. L. Weaver.

Organization, Constitution, and By-Laws: A. W. Harrington, Chairman; G. W. Burpee, W. N. Carey, W. L. Chadwick, and F. A. Marston.

Military Liaison Committee: E. E. Howard, Chairman; G. A. Hathaway, C. S. Proctor, R. E. Dougherty, F. Thomas, W. N. Carey, J. F. Jelley, C. M. Myers, and L. A. Pick.

Centennial Corporation Committee: Carlton S. Proctor, Contact Member.

Committee on Design Professions: C. P. Hazelet, Chairman; W. G. Lyles and a later appointee.

Centennial Planning Committee: As printed in the 1952 Register.

New appointments to the Joint Committees are:

AGC-ASCE Committee on Cooperation (All Oct. 1952): Kirby Smith, Chairman, Contact Member; G. A. Hathaway, E. L. Macdonald, and C. E. Beam, Secretary.

ECPD: V. T. Boughton (Oct. 1952); Harry S. Rogers (Oct. 1953); and A. S. Fry (Oct. 1954).

EJC-ASCE Delegates and Committees, ASCE Delegates on EJC: E. E. Howard (Oct. 1952); G. A. Hathaway (Oct. 1953); and W. N. Carey. EJC Alternate for any ASCE Delegate: L. R. Howson (Oct. 1952).

United Engineering Trustees: G. W. Burpee (Oct. 1952); W. N. Carey (Oct. 1953); and Waldo Bowman (Oct. 1954).

Engineering Societies Library: W. N. Carey (Oct. 1952), and J. K. Finch (Oct. 1954).

Engineering Foundation: Leslie G. Holleran (Oct. 1955); W. N. Carey (Oct. 1952); and Thorndike Saville (Oct. 1954).

American Association for the Advancement of Science: Thorndike Saville and Wilbur M. Wilson (both Oct. 1952).

Student Chapter Installed at Fenn College

A charter for a new ASCE Student Chapter was presented to Fenn College by President Gail A. Hathaway during ceremonies in Cleveland on October 9. Over 50 charter members, plus faculty, alumni, and Cleveland Section representatives, were on hand for the banquet marking the occasion. In his presentation address, President Hathaway indicated the significance of the occasion to the students and emphasized the contribution of the profession to society.

Presiding officer at the installation was Dean G. Brooks Earnest, of Fenn, whose interest and energy aided immeasurably in formation of the Chapter. In his dual capacity (he is also ASCE Director for District 9) Dean Earnest spoke of the opportunities offered aspiring engineers by the various facilities of ASCE, pointing in particular to the strong Local Section program.

Receiving the charter on behalf of the new Chapter were Andrew G. Donovan, president, and Prof. Ernest C. Harris, Faculty Adviser. Activities to which Student Chapter efforts might profitably be bent were outlined by Don P. Reynolds assistant to the Secretary of ASCE, who spoke of the growth of the individual into professional status through association with fellow engineers. Officers of the Fenn Chapter, in addition to Mr. Donovan, are Walter J. Podalny, Jr., Sterling H. Booth, and Thomas A. Weber. The Contact Member is George Sowers, Cleveland consultant.

There are now 132 ASCE Student Chapters with one in every college accredited in civil engineering.

PROMINENT ON PROGRAM at dinner inaugurating ASCE Student Chapter at Fenn College, Cleveland, are, left to right, Don Reynolds, Assistant to the Secretary, ASCE; Prof. E. C. Harris, Faculty Adviser to Fenn Student Chapter; Gail A. Hathaway, then President ASCE; A. G. Donovan, president, Student Chapter; G. Brooks Earnest, Dean of Engineering and Director of ASCE; Prof. G. Barnes, Faculty Adviser to Case Institute of Technology Student Chapter; and Alfred Yanda, president, Cleveland Section of Society.

ECPD Holds Nineteenth Annual Meeting in Boston

Efforts being made here and in Canada to bridge the gap between college and industry by developing programs for the first five years after graduation were reported in a panel discussion featured at the recent two-day annual meeting of the Engineers Council for Professional Development in Boston, Mass. Implementing the six-point training program adopted at the ECPD meeting last year, representatives of education and industry explored various phases of the plan. H. N. Muller, Jr., secretary of the ECPD Training Committee, presided at the discussion, which emphasized the benefits of the plan to both the young graduate and his employer.

Also featured were a session on guidance sponsored by a panel of guidance directors from the Boston area and a report of the Education Committee on adequacy and standards of engineering education. The first of a series of programs to be sponsored by the ECPD Guidance Committee in various parts of the country, the panel discussion on guidance explored the program from the high school's point of view.

Graduates of cooperative courses are a full year ahead in technical know-how of engineering graduates from conventional courses, Harold B. Richmond, chairman of the board, General Radio Company, Cambridge, Mass., told the group in a supplemental talk on guidance delivered at a luncheon meeting. Other speakers included James R. Killian, president of Massachusetts Institute of Technology, who outlined work in student counseling being carried on at M.I.T., and Eugene W. O'Brien, past-president of ASME and vice-president of the W. R. C. Smith Publishing Co., Atlanta, Ga., whose subject was "What Junior Engineers Find Important."

Harry S. Rogers, M. ASCE, president of the Polytechnic Institute of Brooklyn, was reelected chairman for another year during the Council's administrative session, and L. F. Grant, field secretary of the Engineering Institute of Canada, was reelected vice-chairman. The secretary will be E. H. Robie, secretary of the AIME, and the assistant secretary C. E. Davies, secretary of ASME.

It was voted to hold the twentieth annual meeting of the organization at the Hotel Sherman in Chicago, September 11–12, 1952, in conjunction with the ASCE Centennial Convocation.

Applications for Freeman Fellowship Are Invited

Qualified members of ASCE or the American Society of Mechanical Engineers, who have a worthy research program in hydraulics or related fields, are invited to apply for the Freeman Fellowship for 1952. The ASME and ASCE, joint administrators of the fund, make awards in alternate years. In 1952 the award will be made by the ASME. The conditions are as follows:

1. Applicants must submit a program of study or research covering a period of at least nine months starting in 1952, and must include a statement of funds needed from the fellowship.
2. They must furnish evidence of qualification to carry out the proposed program.
3. They must be citizens of the United States and members of either of the two cooperating societies.
4. The Freeman Award Committee will give preference to projects bearing importantly on the defense effort.
5. A report must be made in English by the recipient within sixty days after completion of the project.

Applications should be submitted to the Freeman Fund Committee in care of the Secretary, ASME, 29 West 39th Street, New York 18, N.Y., by February 1, 1952. Announcement of the award will be made by March 15.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

With discussions of fundamental problems of peace and war, of international economic crises and foreign assistance occupying the Washington spotlight, there was less discussion of strictly technical matters during the past month.

Extent of Steel Shortage

Although dissatisfaction has been expressed with respect to D.P.A. allotments of structural steel to several types of construction, no major changes seem to be in prospect. The authorized amounts for the first quarter of 1952 are about the same as for the current quarter. About 50 percent goes to new plant construction. The Department of Defense, the Defense Electric Power Administration and the NPA Railroad Equipment Division account for over 50 percent. Housing, highways, schools, hospitals and water works get about 7 percent.

Of the applications for commercial, recreational and community construction for the fourth quarter of 1951, 63 percent were disapproved by the NPA, Construction Controls Division. In a recent release, NPA advises that those who are not granted their allotments of critical materials for the first quarter of 1952 should reapply for the second quarter in the hope that the materials situation, especially the structural steel shortage, may not be so serious later in the year.

As has been stated often in this column, structural steel is the critical element in the steel shortage. The overall picture with reference to steel, aluminum and copper remains unchanged. Completion of the new steel plants should relieve the steel shortage somewhat after another year. Aluminum may remain on the scarce list somewhat longer; the copper outlook is dark for the duration of the defense effort. Conservation measures involving design changes and substitute materials are necessary for the coming year.

The Construction and Civic Development Department Committee of the U.S. Chamber of Commerce, of which ASCE President Carlton Proctor is a member, reviewed the construction controls situation at a recent meeting. That committee endorsed the recommendation of the steel industry to the DPA that allotments of steel be made only after both military and civilian projects have been screened to determine if the stated requirements for these projects are realistic both as to quantity and timing. The committee further expressed the belief that, with a proper application of conservation measures, there will generally be sufficient construction materials both for essential defense and civilian purposes, provided materials can be channeled to projects as they are really needed. The recommendation was made that DPA forecast to the public the date when resumption of normal civilian construction is likely so that owners and designers may plan accordingly.

Certain construction materials were recently removed from the list of scarce items, covered by the anti-hoarding provisions of the Defense Production Act. They include cast iron, soil pipe, gypsum board, some insulation board and insulating material, and portland cement. Items added include wood piles, plywood and other lumber products.

The OPS has issued a new regulation, CPR 93, in an attempt to set a ceiling on construction prices. It permits the use of current costs of labor and materials in bidding and limits the mark-up for profit to nine-tenths that on comparable bids in the 1949–1950 base period. Since comparison is effective in limiting mark-up, construction prices will be but little affected. Certain additional reporting will be required.

Contract Renegotiation Board Named

Four members of the five-man Contract Renegotiation Board, created by the Renegotiation Act of 1951 (Public Law 9—82nd Congress, 1st Session) have been appointed and have commenced operations with a small staff temporarily located in the GSA Regional Office in Washington. Former Assistant Secretary of the Navy, John T. Koehler, was sworn in as chairman on October 3rd. A lawyer by profession, he has been in government service for the past five years. The chairman of the Appeal Board of the Office of Contract Settlement, Lawrence Hartwig, a lawyer with some government experience, is a member of the Board. Another is John H. Joss, formerly General Counsel of the War Assets Administration and Special Assistant to the General Services Administrator in connection with national defense activities. A banker, Frank L. Roberts, has also been named to the Board. He has served as chairman of the Air Force Division of the Armed Services Renegotiation Board established by the 1948 Renegotiation Act. The fifth member of the Board has not yet been officially named. Key personnel of the staff are already at work. The Board has set March 1, 1952, as the limit for the filing of required statements by persons whose fiscal year ended prior to November 30, 1951.

Although the Renegotiation Act became law in March, little has been done to clarify or interpret its provisions. While renegotiation is the final stage in operation under a contract, many engineers believe that their current operations may be influenced by rulings in regard to possible renegotiation problems. These will be particularly helpful where the provisions of the act vary from those of the 1948 act. For example, under the caption, "Minimum Amounts Subject to Renegotiation," it is stated:

"If the aggregate of such amounts received or accrued during the fiscal year under such contracts and subcontracts is more than $250,000, no determination of excessive profits to be eliminated for such year with respect to such contracts and subcontracts shall be in an amount greater than the amount by which such aggregate exceeds $250,000."

Engineers would appreciate a categorical statement (even though the intent of the act is obvious) that only the excessive profit on contracts above the $250,000 contract amount is to be determined—not as some engineers have feared, that any total amount received over $250,000 might be determined to be excess profits. The itemized estimates of expected costs required to be submitted in connection with certain defense contracts likewise raise some questions as to possible renegotiation procedures. Other questions relating to what contracts or parts of contracts are exempt from renegotiation are expected to be answered by rulings of the new Board.

Washington, D.C.
October 26, 1951

ASCE MEMBERSHIP AS OF NOVEMBER 9, 1951

Members	7,999
Associate Members	10,159
Junior Members	15,386
Affiliates	66
Honorary Members	37
Fellows	1
Total	33,648
(November 9, 1950	30,653)

ASCE Transactions for 1951 Is Available

Members in every Technical Division will find something of interest in Volume 116 of TRANSACTIONS for 1951, which is now available at ASCE headquarters. The volume includes 53 papers that explore latest thinking on virtually every civil engineering subject. One of the papers on foreign projects gives a comprehensive study of hydrology, irrigation, and flood control in Mexico in the most complete coverage of the subject ever made available to United States engineers. Proceedings Separates from November 1949 through November 1950, with their discussions, are also included in Volume 116 as is the address on the status of the Society given by President Gail A. Hathaway at the 1951 Summer Convention at Louisville, Ky.

The 1,482-page volume may be obtained in leather, cloth, or paper binding. Special rates available to members are $4 for the leather-bound copy; $3 for the cloth; and $2 for the paper. In addition, for each of the years members have paid dues, they are entitled to purchase back copies of TRANSACTIONS at the special rate. Members desiring duplicate copies or volumes published before their enrollment in ASCE are given a 50 percent discount privilege on paper-bound copies costing $16. There is an additional charge of $2 for leather and $1 for cloth binding.

Paper-bound copies of Volume 116 have already been mailed to subscribers, and copies in other bindings will be ready for issuance in a few weeks. The charge to non-members is $16 a volume, with the same additional charges for the better bindings. Inquiries should be addressed to ASCE Headquarters, 33 West 39th Street, New York 18, N.Y.

Former Head of E. S. Library Is Dead

Dr. Harrison Warwick Craver, director of the Engineering Societies Library from 1917 until his retirement in 1945, died on July 27, 1951, at the age of 75. Dr. Craver organized and was head of the technology department in the Carnegie Library of Pittsburgh, the first department of its kind in any American public library.

In his 28 years as director of the Engineering Societies Library, he was largely responsible for its growth to the largest public library devoted exclusively to engineering and for development of the literature search, translation, photo copying, and book lending services that extend its usefulness. A member of the American Library Association for over 30 years, he was its president in 1937 and 1938.

SACRAMENTO SECTION INAUGURATES ASCE Centennial year early in November with joint meeting of University of Nevada Student Chapter and Sacramento Junior Forum. Two-day program included talks on the Centennial by ASCE Vice-President Fred C. Scobey and Director Milton L. Wilson and address by Justice Charles M. Merrill, of Nevada Supreme Court. View of head table at joint banquet concluding the program shows, left to right, D. K. McNear, president, Junior Forum; ASCE Director Wilson; Mrs. Blodgett; W. L. McCabe, president, Reno Engineering Club; Mrs. Moyer; Mrs. McCabe; Harlan Moyer, president, Student Chapter; Mrs. Merrill; Mrs. Scobey; Justice Merrill; Vice-President Scobey; H. B. Blodgett, master of ceremonies; R. Robinson Rowe, program chairman; Mrs. McGee; Mrs. Rowe; and H. E. McGee, president, Sacramento Section.

GAIL A. HATHAWAY, Past-President of ASCE (second from right), admires set of book ends, which were processed from local ore and presented to him by University of Kentucky Student Chapter members. Pictured with him, left to right, are Edward Gedrich, president of ASCE Student Chapter; Director G. Brooks Earnest; and Vice-President D. V. Terrell. Mr. Hathaway gave an address on role of Founder Societies in development of professional standards. Numbered among 800 in attendance were faculty members of College of Engineering and student members of ASCE, AIEE, ASME, and AIMME chapters.

Coming Local Section Events

Akron—Meeting at the University Club of Akron on December 13.

Buffalo—Meeting at the Buffalo Athletic Club, December 20, at 12:15 p.m.

Central Illinois Section—Joint dinner meeting with University of Illinois Student Chapter of Men's University Club, December 11, at 6:30 p.m.

Cleveland—Dinner meeting at the Cleveland Engineering Society on December 21, at 6:15 p.m.

Colorado—Meeting at the Democratic Club, Denver, December 10, at 6:30 p.m.

District of Columbia—Meeting in the Cosmos Club Auditorium, Washington, December 11, at 8 p.m.

Illinois—Weekly luncheons every Friday at the Chicago Engineers Club, at 12 noon.

Los Angeles—Dinner meeting at the Alexandria Hotel, Los Angeles, December 12, at 6:30 p.m., preceded by Junior Forum meeting at 6 p.m.

Maine—The annual highway conference will be held at the University of Maine, Orono, on December 15 and 16, under joint sponsorship of the Section and the University of Maine Student Chapter.

Maryland—Meeting at the Engineers Club of Baltimore, December 12, at 8 p.m., preceded by cocktails at 6 p.m. and dinner at 7 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York City, on January 16, at 8 p.m. Meeting of Junior Branch in the ASCE Board Room, New York City, on December 12.

Mid-South—Dinner meeting of Jackson Branch of Section at the Hotel Heidelberg, Jackson, December 27, at 7 p.m.

Montana—Meeting of Hungry Horse Branch of Section at the USBR Conference Hall, December 12, at 8 p.m.

Northwestern—Dinner meeting in the Junior Ballroom of Coffman Memorial Union, University of Minnesota, Minneapolis, on January 7.

Philadelphia—Meeting at the Engineers Club, Philadelphia, December 11, at 7:30 p.m., preceded by dinner at 6 p.m.

Pittsburgh—Joint meeting with Pittsburgh section of Engineers Society of Western Pennsylvania at the Hotel William Penn on December 13.

Providence—Meeting at the Providence Engineering Society on December 13.

Sacramento—Weekly luncheons every Tuesday at the Elks Temple, Sacramento, at 12 noon.

San Diego—Meeting in San Diego on December 18.

San Francisco—Dinner meeting at the Engineers Club of San Francisco, December 18, at 6 p.m.

Tennessee Valley—Meeting of Muscle Shoals Sub-Section on December 20.

West Virginia—Winter meeting at Hotel Frederick, Huntington, on December 7.

Scheduled ASCE Conventions

NEW ORLEANS CONVENTION
New Orleans, La., March 5–7, 1952

DENVER CONVENTION
Denver, Colo., June 16–20, 1952

CENTENNIAL CONVOCATION
Chicago, Ill., September 3–13, 1952

News of Local Sections Briefed

SECTION	DATE	ATTENDANCE	PROGRAM
Akron	October 18	21	Dinner meeting. Dr. Zur-Dau Lee, professor of civil engineering, University of Akron, spoke on conditions in Hong Kong, and Dean R. D. Landon reported on findings of the Engineering Manpower Commission in Pittsburgh.
Buffalo	October 16	25	Luncheon meeting. Robert D. Sipprell, executive director, Buffalo Municipal Housing Authority, discussed proposals concerning housing and slum clearance in Buffalo.
Central Ohio	November 8	...	Joint meeting with Columbus Technical Council. S. O. Evans, chief of engineering development for Babcock & Wilcox Tube Co., compared American and European production facilities and methods.
Cincinnati	October 3	36	W. W. Sanders, city engineer for Louisville, Ky., talked on problems confronting a city engineer.
Colorado	October 1	62	Joint meeting with Colorado section of American Welding Society featuring Martin P. Korn, consulting engineer of Dearborn, Mich., as speaker.
District of Columbia	October 9	163	Meeting conducted by Junior Forum. Alvin R. Schwab, resident engineer, birdge department, Southern Railway Co. and instructor on civil engineering faculty at George Washington University, presented an illustrated talk on prestressed concrete.
Duluth	October 15	...	Dr. Robert Heller, faculty member of University of Minnesota, presented an illustrated talk on "The Geology of the Hawaiian Islands."
Florida Gainesville Sub-Section	October 25	...	Dinner meeting featuring Walter Furst, director of utilities, City of Gainesville, Fla., as speaker.
Georgia	November 2	...	"A Washington Report" was discussed by the Hon. James C. Davis, Georgia Congressman.
Illinois	October 3	...	Joint meeting with Mechanics Colloquium, Department of Mechanics of Illinois Institute of Technology and Armour Research Foundation. "Blast Effects upon Structures in the Plastic Range" was discussed by S. J. Fraenkel, assistant chairman, Armour Research Foundation, and L. E. Grinter, research professor of civil engineering at I.I.T.
Indiana	October 17	57	Joint dinner meeting with Rose Polytechnic Institute Student Chapter. T. N. Bergendoff, partner in consulting firm of Howard, Needles, Tammen & Bergendoff, at Kansas City, Mo., gave an illustrated lecture on trends in bridge and expressway planning and design.
Kansas	October 11	127	Joint meeting with Kansas University and Kansas State College Student Chapters. Panel discussion on floods and flood control—with Dean T. DeWitt Carr, University of Kansas, acting as moderator—was presented. Participants included John Ise, professor of economics, Kansas University; W. E. Steps, engineer in charge of watershed investigations, Division of Water Resources, Kansas State Board of Agriculture; W. C. McNown, professor emeritus of civil engineering, Kansas University; and Col. Lawrence J. Lincoln, district engineer, Corps of Engineers, Kansas City, Mo., District.

North Carolina	October 12	26	Annual meeting. Business and technical sessions and luncheon. Principal speaker was Nello L. Teer, Jr., of Nello L. Teer Co., at Durham, N.C., who discussed contractor's views on highway and airport construction. Election of Carroll L. Mann, Jr., as president; P. D. Davis, senior vice-president; E. B. Rice, junior vice-president; and Ralph E. Fadum, secretary-treasurer.
Oregon	November 6	...	Porter W. Yett, general contractor, outlined developments in highway paving work.
Philadelphia	October 9	...	Joint meeting with Metropolitan-Philadelphia chapter of American Public Works Association. Inspection trip to Penrose Avenue Bridge. Dinner meeting with L. L. Lessig, contracting manager for Bethlehem Steel Co.; E. L. Schmidt, chief engineer, Pennsylvania Department of Highways; F. M. Masters, of the consulting firm of Modjeski & Masters; and E. L. Durkee, engineer of erection, Bethlehem Steel Co.; speaking, respectively, on steel construction, planning, design, and erection of Penrose Avenue Bridge.
Delaware Sub-Section	October 16	55	Carl Peterson, project engineer for Howard, Needles, Tammen & Bergendoff, presented an illustrated talk on New Jersey Turnpike.
Providence	October 11	20	Col. John W. McGreevy, executive director of Rhode Island State Council of Defense, spoke on "Rhode Island Civil Defense—Heavy Rescue Services."
San Diego	October 30	58	ASCE Director W. L. Chadwick commented on Society affairs. E. W. Blom, assistant city manager of San Diego, spoke on the engineer in administrative positions.
Toledo	October 31	18	Election of Harry Grell, Jr., as secretary-treasurer. Don Reynolds, Assistant to the Secretary, ASCE, gave an informal talk on Society activities.
Tri-City	October 16	98	Joint meeting with Kewanee chapter of Illinois Society of Professional Engineers. Speakers for evening were Charles H. Young, consulting engineer, Muscatine, Iowa, and Ingeman Clausen, civil engineer, Corps of Engineers.

PARTICIPATING IN PROGRAM at annual student night and joint meeting of Boston Society of Civil Engineers, Northeastern Section of ASCE, and Student Chapters in area held at Northeastern University recently are (left to right) Howard J. Williams, president, Northeastern Section of Society; Dr. D. B. Steinman, New York City consultant and bridge designer; and Prof. John B. Wilbur, president of Boston Society of Civil Engineers. More than 300 students attended joint session at which Dr. Steinman spoke on bridge design, reviewing the field from 1889 to the present.

RETIRING PRESIDENT of Texas Section Raymond Dawson (left) passes gavel of office to incoming President T. C. Forrest, Jr., at recent fall meeting of Texas Section.

ASCE Wives in Northern California Form Group

Word of a flourishing organization of wives of members of ASCE and the Structural Engineers Association of Northern California, with headquarters in San Francisco, comes from Mrs. Edward F. McKeon, secretary of the group. The organization, which is called "The Femineers," was established in May 1950 for the purpose of promoting acquaintanceship among the members and of assisting at conventions of the two societies.

Their program this fall has featured monthly luncheon meetings, with talks on educational subjects; participation in the three-day fall convention of the Structural Engineers Association; and a "fall fiesta."

Data on John F. Stevens, Past-President ASCE, Sought

Members with documents or personal letters relating to the career of the late John F. Stevens, long-time member and former President of ASCE, are asked to communicate with his son, John Frank Stevens, who is gathering material for a biography of his father. He may be reached at the Hotel Margaret, Brooklyn 2, N.Y.

Mr. Stevens' distinguished career included the location and construction of important railroads; the discovery of Marias Pass in Montana, where his statue now stands; the basic planning of the Panama Canal and the organization of the forces for its construction; and the operation of Russian and Siberian railroads during and after World War I.

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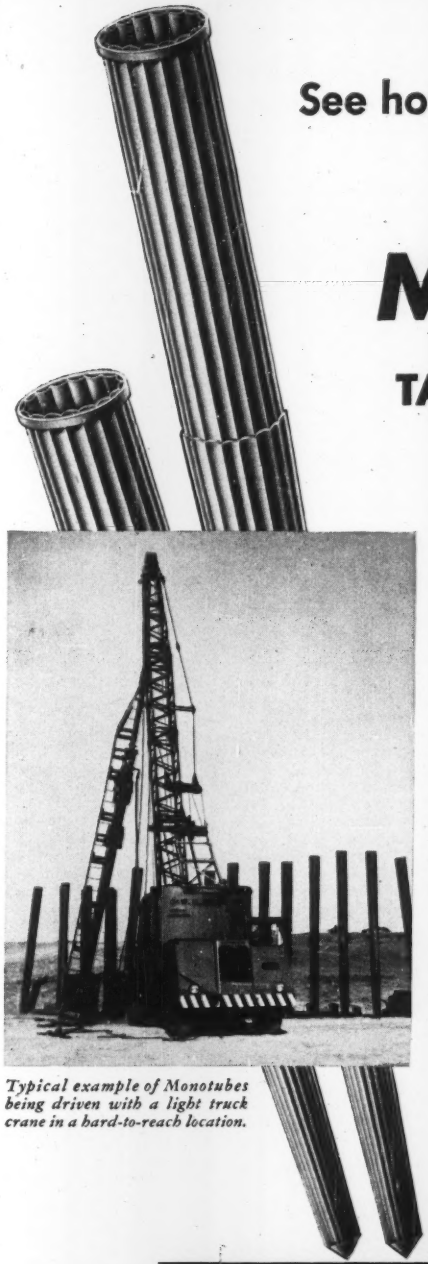

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CRITICAL MATERIALS SAVED! Because of Monotubes' proven excellence in transmitting loads to penetrated soil, plus assurance of their condition after installation, Monotubes can be designed for heavy loads. Result—fewer piles may do your job.

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What's more, cold rolling of the steel to form Monotubes' flutes greatly increases the strength of the steel. And, besides increasing the surface area, these longitudinal flutes give the pile stiffness to permit driving without a mandrel. Another advantage—the joints between sections are fully welded to provide strength in all directions . . . so that assembled Monotubes are actually one integral unit for design considerations. Monotubes come in lengths, gauges, tapers and diameters to meet varying soil conditions. Write for information. See how they can make important savings on all types of foundation jobs. The Union Metal Manufacturing Co., Canton 5, Ohio.

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NEWS BRIEFS . . .

Moles Announce 1952 Construction Awards

Selection of two contractors to receive The Moles twelfth annual awards for service to the American construction industry is announced by Award Committee Chairman George Ferris. The member award winner is Charles B. Spencer, M. ASCE,

Charles B. Spencer

Stephen D. Bechtel

president of the New York City engineering and construction firm of Spencer, White & Prentis, and the non-member winner Stephen D. Bechtel, Assoc. M. ASCE, president of the Bechtel Corporation, of San Francisco. Both firms are internationally known, primarily in the field of heavy foundations.

Each year The Moles, a New York association of leaders in the heavy construction industry, honors one member and one non-member for "outstanding contributions to construction progress." Presentation of the awards will be made at The Moles annual dinner, to be held at the Waldorf-Astoria in New York on February 6.

Registration Gains Reported at NCSBEE Annual Meeting

There are now about 165,000 registered professional engineers in the country, and during the past year thirteen states amended their registration acts in an effort to clarify and strengthen their requirements. These facts were made known at the 30th annual meeting of the National Council of State Boards of Engineering Examiners held in Boston, October 21–24. The attendance of over 100 included official delegates from 44 states and guests representing all the principal engineering societies, including two from Canada.

Of special interest was the report of the Committee on Qualifications for Registration, with recommendations regarding written examinations, and the report of the Committee on Engineers-in-Training. The principal speaker at the annual banquet was H. S. Rogers, M. ASCE, president of the Polytechnic Institute of Brooklyn, whose subject was "Engineering—a Dynamic Profession." The National Council's Distinguished Service Certificate which is awarded to members of State Boards who have served for over 20 years was presented to Dean R. A. Seaton of Kansas, Charles A. Halbert of Wisconsin, and Herbert D. Mendenhall, M. ASCE, of Florida.

New officers elected were: president, C. S. Crouse, head of the Department of Mining and Metallurgy at the University of Kentucky; vice-president, A. G. Stanford, consulting engineer of Atlanta, Ga.; director of the Central Zone, Bruce Williams, the Bruce Williams Laboratories, Joplin, Mo.; director of the Southern Zone, James H. Sams, dean of engineering at Clemson College; and director of the Northeast Zone, Junius T. Moore, president of the Fireproof Products Company, Charleston, W.Va. T. Keith Legaré of Columbia, S.C., continues as executive secretary, an office he has held for the past 28 years.

The next annual meeting of the NCSBEE will be held at Colorado Springs, Colo., September 4–6, 1952, and the 1953 annual meeting will be held in San Antonio, Tex.

New Jersey Turnpike Will Be Featured in January Issue

To mark the opening in January of the final section of the New Jersey Turnpike, the January issue of CIVIL ENGINEERING will carry, in addition to usual articles and features, 50 or 60 pages devoted to the planning, financing, design, and construction of the Turnpike. The first complete coverage of all phases of the project, the dozen articles constituting this supplement were originally presented at the Society's recent Annual Convention under the joint sponsorship of five ASCE Technical Divisions.

The Turnpike—a 118-mile, ultra-modern highway extending from southern New Jersey to the George Washington Bridge—stands as a construction miracle, in an age of construction phenomena, for the speed of its planning and building, its tremendous cost, and its solutions to the multiple problems involved in building across the Jersey swamps and through the highly congested industrial corridor to New York City. Planned and built in only thirty months at a cost of $255,000,000, the project incorporates many construction innovations. These include erection across the Passaic and Hackensack rivers of the two longest plate-girder spans ever built in the United States, stabilization of roadway foundations across the New Jersey marshes, and use of asphaltic concrete for the entire paving job.

Covering all aspects of the project from inception to construction of service facilities, the articles in the January issue will deal specifically with organization and procedure; traffic surveys; economic feasibility; design standards and construction schedules; foundation problems posed by the Jersey Meadows; application of soil mechanics; conception and design and fabrication and erection of the Hackensack and Passaic River bridges; design of the pavement; construction methods, materials and equipment; and service facilities.

WORK ON NEW JERSEY TURNPIKE reaches final phases with rolling of first-course bituminous concrete on northbound lane, north of Haddonfield-Berlin Road. Selection of asphaltic concrete pavement for project was dictated by a preferential bid of $5,420,134 less than that for a concrete pavement.

Huge Steel-Producing Facility Begins Operation

In a major industrial celebration held in Pittsburgh on October 30, the first unit in a $70,000,000 steel-producing facility under construction by the Jones & Laughlin Steel Corporation went into operation. The ceremonies consisted of the tapping of first heat from a giant open-hearth furnace, the first of eleven to be completed by next March, and talks by leaders in government, industry, and labor. Speakers included Charles E. Wilson, defense mobilization director, and Admiral Ben Moreell, Hon. M. ASCE, president of Jones & Laughlin. Both hailed the project as vitally important in helping strengthen the nation's defense production program by providing more steel for essential products.

Tapping the first furnace came only 17 months after the start of the huge project in May 1950. Because of the critical need for steel, each furnace is being placed in production as soon as it is completed even though the building itself is unfinished. With a total annual productive capacity of 2,000,000 tons of steel, the open-hearth project is the largest single achievement in the corporation's five-year $400,000,000 expansion and modernization program for its mills, mines, and transportation facilities—a program that upon completion in 1952, will increase the steel-producing capacity of the organization 32 percent.

Other improvements at the Pittsburgh works include a new blooming mill, three new soaking pits to prepare the additional steel output for rolling, scrap-handling equipment for feeding the furnaces with some 70,000 tons of scrap each month, a new 10-in. bar mill, new central scarfing facilities for handling the semi-finished steel, and expanded rolling facilities for a 96-in. strip mill.

DEFENSE MOBILIZATION DIRECTOR Charles E. Wilson (right) and Admiral Ben Moreell, Hon. M. ASCE, president of Jones & Laughlin Steel Corporation, are shown just before giving signal for tapping heat from new 250-ton steel furnace at Pittsburgh works of Jones & Laughlin. Furnace is first of eleven scheduled to go into operation by March in corporation's new $70,000,000 open-hearth shop.

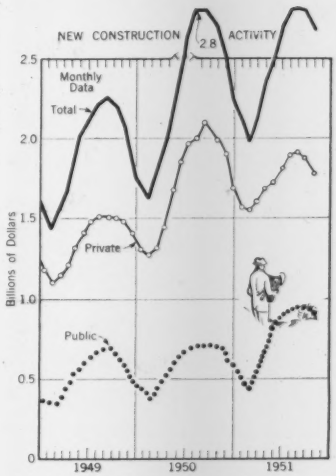
Construction Activity in October Is Off 5 Percent from September

Shortages of materials retarded almost all types of construction in October, resulting in a more than seasonal decline in building activity, the U.S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the Department of Commerce note in a joint report. Delays in construction projects extend even to the basic steel and power expansion programs, they state.

The total value of new construction put in place during the mouth amounted to about $2.7 billion, a decline of 5 percent from the September total and of 3 percent from the October 1950 total. Although most types of construction activity begin a seasonal decline from September to October, the drop this year was larger than usual. New home-building activity, which increased slightly during the mouth, was a notable exception to the general trend. Military and defense plant construction also showed further moderate increases.

Both private and public outlays for new construction dropped during the month. Total private outlays amounting to $1,789 million were 5 percent less than in September, and public expenditures of $903 million were off by 6 percent. Private construction was 12 percent under a year ago, while public construction showed an increase of 21 percent over the year.

With construction coming completely under the Controlled Materials Plan on October 1, the amount and type of building that can be carried on depend on supplies of controlled materials on hand before that date and on allotments of steel, copper, and aluminum. Structural steel was the principal limiting factor during October and probably will continue as the key material throughout the balance of the year. However, the joint agencies predict that within a short time the availability of copper items may be expected to supersede structural steel as the determining factor in the volume of construction activity, particularly for types of construction in which structural steel is relatively unimportant.



MORE THAN SEASONAL DROP in building activity for October is indicated in Department of Commerce curves.

Despite the current drop in construction activity, new construction with a total value of more than $25 billion was put in place during the first ten months of the year—$2 billion more than the total outlay for the same period in 1950. Indications are that total new construction outlays for the year will be in excess of $29 billion, compared with less than $28 billion for all of 1950. Larger public expenditures, particularly for housing, defense plants, and military facilities, will account for the increase.

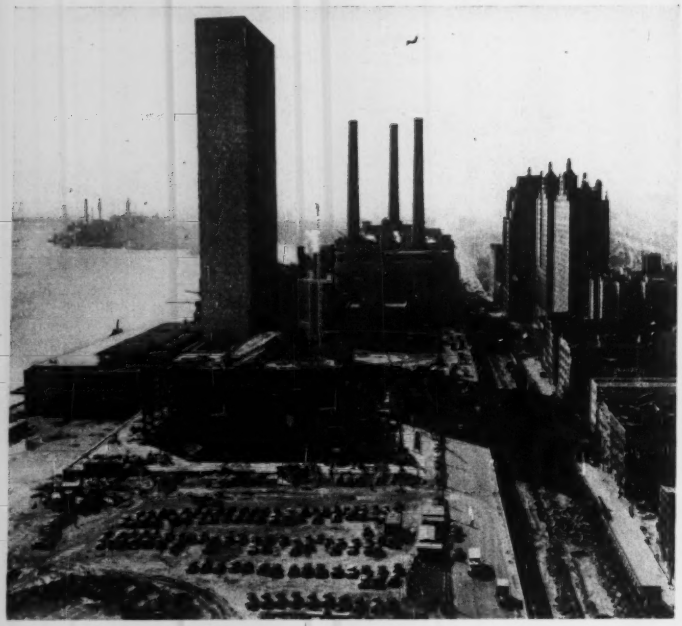
New Metals Studied at World Metal Congress

Molybdenum, titanium, boron, and newly announced synthetic metals were cited as the visible accomplishments of modern metallurgy in lectures and exhibitions featuring the World Metallurgical Congress, held recently in Detroit, Mich., under the auspices of the American Society for Metals. The first international conclave concerned with a world science of metals, the congress was attended by representatives of 37 nations.

Molybdenum, which is in large supply in this country, was disclosed as now ready for jet engine manufacture. One ounce of boron added to a ton of steel, it was pointed out, cuts the need for other less available ingredients nearly in half. Titanium was called "the metal to watch." The steel parts of planes and all light construction may be replaced by it, Dr. Zay Jeffries, director-general of the congress, predicted. He noted that it is more prevalent in the earth's surface than copper. The Carboloy Department of the General Electric Company announced the development of new synthetic (chrome carbide) metals, "which can replace strategic tungsten with more efficiency."

Frank X. Higgins, project administrator for the Economic Cooperation Administration, hailed the congress as "the largest ECA technical assistance program ever staged," and said it "successfully brought about an information exchange between American and foreign metal men."

Progress at U.N. Permanent Headquarters Site



CONSTRUCTION PROCEEDS AT SITE OF UNITED NATIONS $65,000,000 permanent headquarters on East River in New York, with completion scheduled for next winter. Already in use are 39-story Secretariat Building in background, library and 1,500-car underground parking garage constructed by U.N., at request of city, for visitors and personnel. Partly completed General Assembly Hall is shown in foreground. As supplemental project at U.N. cost, City of New York is now building First Avenue Tunnel; widening 42nd and 47th Streets; creating parks on 42nd Street, First Avenue, and 47th Street; and reconstructing Roosevelt Drive. Contractors on U.N. building program are Slattery Construction Co., Inc., George A. Fuller Co., Turner Construction Co., Inc., and Walsh Construction Co. World Wide Photo.

Decline in 1952 Construction Dollar Volume Forecast

The construction dollar volume in the 37 states east of the Rockies is likely to run 10 percent less in 1952 than in 1951 in the opinion of the F. W. Dodge Corporation, fact-finding organization for the construction industry. The estimate, made jointly by Thomas S. Holden, president, and Clyde Shute, assistant vice-president and manager of the statistical and research division, is published in *Architectural Record*.

Noting that construction projects that were refused allotments of critical metals in the fourth quarter of 1951 were deferred, not abandoned, the study points out that their requirements can be reconsidered and granted in later quarters. Consequently these projects represent a certain amount of construction demand that will carry over into 1952. Population growth and other expansion factors causing potential construction demands to accumulate during the current period of metal shortage are also cited.

Despite these facts, the report anticipates "that the fourth-quarter dip in contract volume will carry over into 1952, and might even continue through the middle of the year. If the anticipated improvement in the metals situation and easing of controls take place, there should be a definite uptrend of contract volume in the second half of 1952."

Residential building will decline more than any other classification, according to the forecast, while public works and utilities will decline least. All classifications show expected declines, except privately owned utilities, marked for a 31 percent gain. Despite an anticipated decline of 19 percent in new dwelling units started, based on Department of Commerce figures, a total of 850,000 units is forecast by the officials.

In the opinion of a substantial majority of 128 economists polled by the corporation, the nation's output of goods and services will reach a new high in 1952. The average of all estimates indicates an annual output rate of $334.3 billion in the fourth quarter of this year, and of $348.6 billion for the fourth quarter of 1952. The government has estimated that the output for the third quarter of this year was $328 billion. It is the consensus of the group that wages and prices (wholesale and consumer) will increase moderately, though not on a runaway scale. Industrial production will rise continuously from now until the end of 1952. Although a moderate decline in construction is anticipated, it will still be of boom proportions.

The median date named for the end of use controls on steel was the second quarter of 1953. The median date for the end of controls on copper was the third quarter of 1953, and on aluminum, prices, wages, and salaries, the fourth quarter of the same year. Half the participating economists based their expectations on the assumption that our armed forces will be engaged next year on about the same scale as this year.

Aluminum Producers Report on Expansion of Industry

Continuing progress in the aluminum industry's current expansion program was reported by primary aluminum producers and fabricators attending the autumn meeting of the Aluminum Association, held in New York, October 23–25. The report confirmed expectations that by the end of next year the primary aluminum capacity of the nation will be approximately 60 percent greater than the 1950 level, and that additional capacity is scheduled to go into operation in 1953.

Operation under present government restrictions and how best to meet mounting demands for defense were topics receiving major attention. A. P. Cochran, of the Cochran Foil Company, Inc., Louisville, president of the Association, presided.

AEC Extends Contract for Operation of Hanford Works

The Atomic Energy Commission has extended for five years the General Electric Company's contract for operation of the Hanford (Wash.) Works and the Knolls Atomic Power Laboratory at Schenectady, N.Y. Under the terms of the new agreement, the AEC will accept assignment of existing construction contracts for both and make direct award of future construction contracts. The General Electric Co., which previously has had responsibility for construction under its contract, will continue to furnish architect-engineer management and other related construction services.

Pennsylvania Opens Final Section of Turnpike

Completion of the final link in the main system of the Pennsylvania Turnpike was celebrated on November 26 in ceremonies marking the opening of the 67-mile Western Extension of the superhighway that now crosses the State. The original 160-mile section of the turnpike, between Carlisle and Irwin, was opened to traffic on October 1, 1940, and the Philadelphia Extension, a 100-mile link connecting Carlisle with Valley Forge, was opened ten years later. The newly completed Western Extension will route traffic around Pittsburgh by way of Irwin.

Construction of a Northeastern Extension of the Turnpike, from King of Prussia near Philadelphia to the Delaware River, south of Morrisville, Pa., will be started soon. It will connect with a similar extension of the New Jersey Turnpike by a bridge across the Delaware.

U.S. Roads to Receive Half Billion Federal Aid

State-by-state apportionment of the $500,000,000 federal aid highway fund for the fiscal year beginning in July is announced by Charles Sawyer, Secretary of Commerce. New York, with an allotment of $30,724,302, heads the list of states sharing in the fund, Texas with $29,681,979 is second, and California with $26,155,386 is third. Vermont's share of $1,993,186 is smallest.

The Federal Aid Highway Act, approved in September, provided $225,000,000 for projects in the federal-aid system; $150,000,000 for secondary road projects; and $125,000,000 for projects in urban areas. Under the general procedure in use for a number of years, the funds will be expended under the supervision of the Bureau of Public Roads. Projects are proposed by the state highway departments, which prepare plans, award contracts, and supervise construction. Federal participation is limited to half the cost of projects.

Contracts Awarded for Pipeline Construction

Award of the final three pipeline job contracts and the remaining river crossing contracts in the construction of the Texas Eastern Transmission Corporation's 791-mile 30-in. pipeline from Kosciusko, Miss., to Connellsville, Pa., is announced by the company. Anderson Brothers Corporation, of Houston, Tex., receives the contracts for Jobs 8, 9, and 10 extending from the Ohio River near Portsmouth, Ohio, to a point near Connellsville.

Contracts for crossings under the Hocking, Muskingum, and Monongahela rivers, and the Ohio-West Virginia crossing of the Ohio River go to Williams Brothers Company, of Tulsa, Okla. Pentzien, Inc., of Omaha, Nebr., has been awarded a contract for a pipeline crossing under the Ohio River near Portsmouth.

Columbia University Launches Drive for Engineering Center

A drive for funds for the first $13,000,000 unit in a Columbia University Engineering Center fund campaign for $22,150,000 was launched at a dinner at the Waldorf-Astoria in New York on November 7. Already alumni and friends of the university have contributed $2,000,000 toward the first unit, a 14-story structure to front on Riverside Drive and the Hudson River at 125th Street.

According to Dr. John R. Dunning, dean of engineering, the center will expand the effectiveness of the Engineering School through two powerful teaching arms—an "Institute of Advanced Engineering Science to press forward the frontiers of scientific knowledge applied to engineering," and a "Division of Cooperative Research in Engineering for close cooperation in applied research with industry."

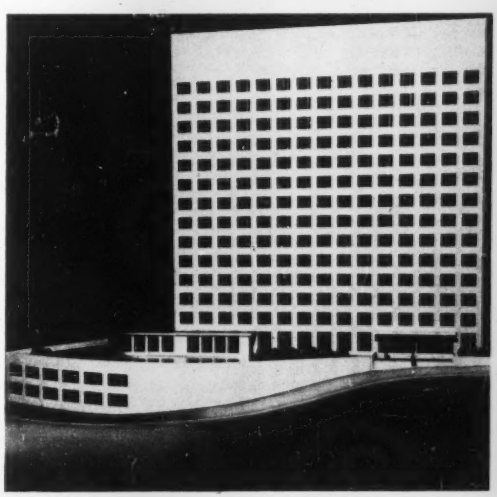
The center is visualized as a union for teaching, research, and the fundamental sciences. It will be equipped for engineer-scientists to develop techniques for discovering new deposits of basic metals and cheaper methods of extracting values from the ore; to increase the food productivity of our soil through irrigation, fertilization, and mechanization; to extend the use of devices that "think"; to produce more economical shelters and facilities for human comfort; to improve transportation on the sea, the land, and in the air; to facilitate communication by radar, television and other electronic developments; and most important to push further the development of energy from coal, oil, falling water, and atomic power. The main building is scheduled for completion in 1954, Columbia's bicentennial anniversary.

As guest speaker, Herbert Hoover, Hon. M. ASCE, pointed out that our nation has "neither enough engineering teachers nor enough students to carry on the nation's work. We do not have enough research facilities to assure the needed flow of new inventions and improvements. We need 60,000 engineering graduates a year to supply national needs. Only 38,000 graduated in 1951."

Mr. Hoover asserted that, "One reason for this drop is that a young mechanic with three years of training, during which he is paid, can earn more take-home pay after taxes than a young engineer with six years of training and three more years of experience." He made a plea for more scholarships to needy boys "who are willing to put in nine years with little reward."

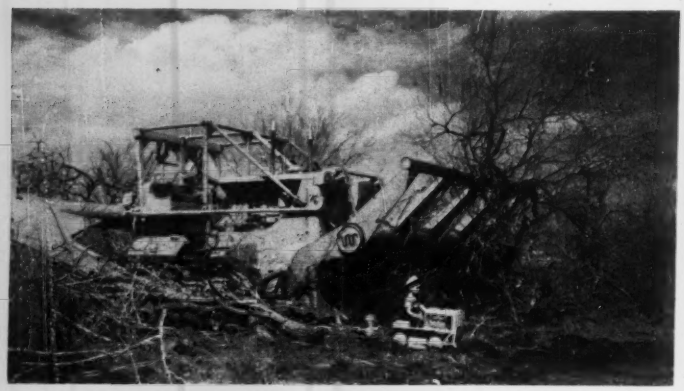
Mr. Hoover was joined in urging support of the Engineering Center by other speakers, including Dr. Irving Langmuir, recipient of the 1932 Nobel Prize in Chemistry; Gen. William J. Donovan, special adviser to the president of the university; Dr. Grayson Kirk, vice president-provost of Columbia; and Dr. John R. Dunning, dean of engineering. Felix E. Wormser, general chairman of the Columbia University Engineering Center Development Fund, presided. In a message to the guests, General of the Army Dwight D. Eisenhower, president of Columbia on leave to the North Atlantic Treaty Organization, said: "The Engineering Center at Columbia will bring fuller exploitation for man's benefit of the technical leadership, wide knowledge, and scientific momentum already present in the university."

Among the 400 prominent engineers in attendance at the announcement dinners were officers of the leading engineering societies. ASCE was represented by its President, Carlton S. Proctor.



MAIN BUILDING in proposed Columbia University Engineering Center, fronting on Riverside Drive at 125th Street, New York City, is shown here in artist's conception.

Twin Tractor Colossus Attacks Texas Land-Clearing Problem



NEW IMPETUS IS GIVEN TO LONG-RANGE BRUSH CONTROL PROGRAM on King Ranch in Texas by 52-ton twin tractor unit developed for the program from the twin "Cat" D8 Tractor by two Caterpillar dealers—Peterson Tractor & Equipment Co., of San Leandro, Calif., and the William K. Holt Machinery Co., of San Antonio, Tex. Resembling the twin-tractor arrangement devised last year, the new version is a high-clearance unit with 270 hp and 65,000-lb drawbar pull. Because of the special application, it has a 13½-ft gauge and 3-ft ground clearance—obtained by placing an additional final drive bullgear over the regular one. Extending out in front is seven-ton Holt Funnel Dozer, consisting of standard bulldozer blade with two large knockdown bars or pipes in front. This angling-type blade is cut in two, with the sections mounted at 45-deg angle. In operation, the arms push the brush over, and the blade sections conduct it between the tracks. The 3-ft ground clearance allows the tractor to pass over the brush without excessive use of power. A rear mounted Holt Root Plow has a heavy-duty, double V-type blade that travels approximately 16 in. below the ground surface, cutting stumps and roots below the bud ring. Weight of the 16-ft plow is six tons. Both plow and funnel dozer operate from a rear-mounted cable control unit. Machine can clear about four acres of dense brush and mesquite trees (some of them 40 ft high) per hour.

Virginia Engineers Study Road Problems at Two Meetings

Numerous aspects of the highway and traffic problem were discussed at two recent annual meetings of Virginia road engineers—the fifth annual Virginia Highway Conference at Lexington and the seventeenth anniversary meeting of the League of Virginia Counties at Williamsburg.

"The failure of the human element" as a major cause of highway accidents was emphasized in sessions of the three-day Virginia Highway Conference, sponsored jointly by the Virginia Department of Highways and the civil engineering department of Virginia Military Institute. Motorists can kill themselves on the most modern of highway facilities, F. N. Barker, chief highway engineer of Illinois, told a record attendance of over 750 at a final general session. "Modern highway design, of course, counts in our efforts to check death on the highways," he said. "However, the so-called 'foolproof' highway has not been designed."

Others appearing on the program, which was dedicated to the three-E program of highway safety—engineering, enforcement, and education—included W. Robie Dunman, of Washington, assistant director of the President's Highway Safety Conference; Charles M. Noble, M. ASCE, chief engineer of the New Jersey Turnpike Authority; Fred Burggraf, M. ASCE, director of the Highway Research Board, Washington, D.C.; Judge James P. Economos, director of the American Bar Association's Conference of Traffic Court Judges and Prosecutors, Chicago; and Dr. Herbert J. Stack, director of the New York University Center for Safety Education.

Virginia will have 16,000 miles of hard-surfaced roads in its secondary system by 1956, State Highway Commissioner James A. Anderson, M. ASCE, predicted in a major address at the meeting of the League of Virginia Counties. With 12,349 miles of hard-surfaced roads already in the secondary system, the predicted goal amounts to a 3,651-mile increase. In pointing out the problems of the highway department, Mr. Anderson noted that while motor vehicle registration in the United States jumped 5 percent over the 1940–1950 period, the increase in Virginia during the same period was 89 percent.

Cornerstone Is Laid for Rockaway Treatment Works

Cornerstone laying ceremonies were held October 26 for the Rockaway Pollution Control Project, the last unit in a program of the New York City Department of Public Works to eliminate all dumping of raw sewage into Jamaica Bay and permit restoration of the entire region as a recreational area. The principal speaker at the cornerstone laying was Joseph T. Sharkey, Acting President of the City Council.

Designed for an initial capacity of 15 mgd, the new sewage treatment works will serve the entire Rockaway peninsula and a population of about 90,000. Employing the activated sludge process, the plant includes enclosed screen and grit chambers, pump and blower house, four aeration tanks, four covered sedimentation tanks, final effluent screens, chlorine contact tanks, four 50-ft-dia digestion tanks with floating covers, and a 60-in. outfall sewer to Jamaica Bay. It is being built by Merritt-Chapman & Scott Corporation, and is now approximately 80 percent completed.

In combination with three other plants already in operation, the Rockaway project will permit treatment of all sewage entering Jamaica Bay. The others are the Coney Island and 26th Ward plants in Brooklyn, and the Jamaica plant in Queens.

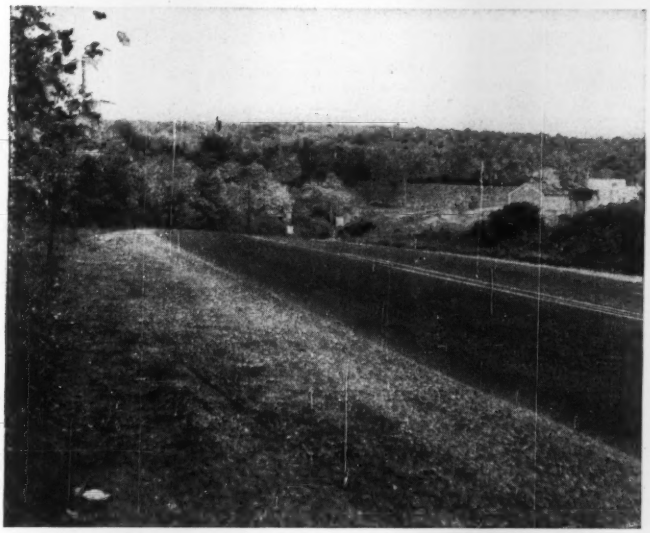
Irrigation Repayment Contract Negotiated by USBR

A $42,000,000 repayment contract between the Bureau of Reclamation and the Wellton-Mohawk Irrigation and Drainage District for the construction of an irrigation system to serve the Wellton-Mohawk division of the Gila project in southwestern Arizona has been approved by the Department of the Interior. Construction of the Wellton-Mohawk's irrigation works was authorized by the Gila Project Reauthorization act of July 30, 1947, which established the Gila Project area at 115,000 irrigable acres—40,000 in the Yuma Mesa division and 75,000 in the Wellton-Mohawk division.

Under the contract the Bureau will construct the Wellton-Mohawk, Wellton, and Mohawk canals, three main pumping plants, a distribution system, protective works, and drainage works. The canals, protective works, and pumping plants are now under construction. Work is already completed that will serve the Wellton-Mohawk division and the balance of the Gila project include Imperial and Laguna dams on the Colorado River above Yuma, Ariz., and the Gila gravity main canal.

The estimated cost of the project is $560 an acre, repayable over a 60-year period which will be preceded by a ten-year period designated a development period.

BETTER ROADS the YEAR 'ROUND



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New Appropriation Speeds Missouri Basin Projects

Recent Congressional appropriations of $91,008,000 for Corps of Engineers flood control and river development work in the Missouri Basin will carry construction on two major Missouri River dams past the half-way mark, complete a tributary dam, and expedite construction of eight other projects. The only new project work authorized is on the Gavins Point Dam, for which $2,000,000 was allotted. Initial construction on this project will include access road facilities, excavation work at the dam site, and engineering design.

The initial appropriation for the Gavins Point work was deducted from the appropriation for Fort Randall Dam in South Dakota. This decision was based on the close functional relationship of the two dams and on the fact that the combined projects will provide a substantial increase in hydroelectric power production. In addition to having a direct power potential of 100,000 kw, the Gavins Point Dam will serve as a reregulating structure that will smooth the flow from Fort Randall Dam and permit peaking of the full power potential at that project.

Allotments of $37,083,700 and $34,699,000 for Garrison and Fort Randall dams, respectively, will enable construction to proceed on schedule. By July 1, Garrison Dam will be approximately 52 percent completed, and Fort Randall Dam about 60 percent completed. Harlan County Dam on the Republican River in Nebraska will be essentially completed next year and placed in operation. An appropriation of $4,500,000 will permit flood protection works at Kansas City, Mo., and Kansas City, Kans., to be about 82 percent completed by the end of the fiscal year.

Morrisville Steel Plant to Use Delaware River Water

About 230,000,000 gal of water will be required daily for the new Fairless works of the United States Steel Corporation under construction at Morrisville, Pa. To be pumped from the Delaware River, this huge volume of water—enough to supply two-thirds of the needs of Philadelphia—will be supplied in three degrees of purity, through three individual systems: (1) General process water for cooling, quenching, and washing, (2) special process water for boilers, sanitary facilities, and showers, and (3) pure water for drinking.

Pumping installations for water and sewage and wastes treatment will be centrally located along the Delaware River in an area approximately 2,200 ft long and 1,400 ft wide. On this site will also be located a basin for settling solids from the water, plants for waste treatment, a central controls building, and an outdoor electrical substation. About 50 miles of steel, cast iron, and concrete pipe up to 72 in. in dia will be required for the distribution networks.

The greatest volume of water will be needed for general service. This supply will be taken from the river surface through five bays at the front of the pump station or through two cribs submerged offshore. The offshore inlets are provided in case blocks of ice in the winter obstruct flow over the surface sills into the intake wells. After mechanical cleaning the water will be directed to service wells and then pumped to a settling basin, where it will be held 80 min before it is ready for use. Special process water for the boilers and the sheet and tin mills will be prepared by filtering river water through sand and gravel beds and then treating it with chlorine. Drinking water will be drawn from ground wells by electric pump.

Sanitary wastes and contaminated water from the three distribution systems will be trapped in sewers and treated before being returned to the river.

New Stabilizing Process Speeds Concrete Form Removal

EXCEPTIONALLY EARLY REMOVAL of forms for beams with large overhang is permitted by use of Vacuum Process for stabilizing concrete. Potentialities of process are indicated by photo taken following removal of forms—only 55 min after concrete had been placed in them. Although concrete had not reached its initial set, it was so hard that nail marks could barely be made on the surface. In experiment, one part standard Portland cement was used to two parts of sand and three parts of ¾-in. gravel. Concrete was vibrated and Vacuum Processed through the side forms by means of a mat placed on top of the beam. Vibrating was discontinued after 30 min, but Vacuum Processing was continued for another 25 min before removal of forms. Plywood forms were held to floor by vacuum cups, which speed installation and eliminate need for bracing.

Army Map Service Activates Providence Field Office

As part of a plan to expand essential map production for the Department of Defense, the Army Map Service has just established a field office at Providence, R.I., according to an announcement from the Department of the Army. Approximately 300 locally recruited personnel will be employed in the Providence office, which will be located at 1 Washington Avenue. The work will include drafting and map compilation from source materials furnished from Washington, D.C.

Field offices for the Army Map Service were established earlier in the year at Louisville, Ky., and Kansas City, Mo., and plans are being made for the activation of additional units soon.

Aluminum Production Rises Six Percent in Last Quarter

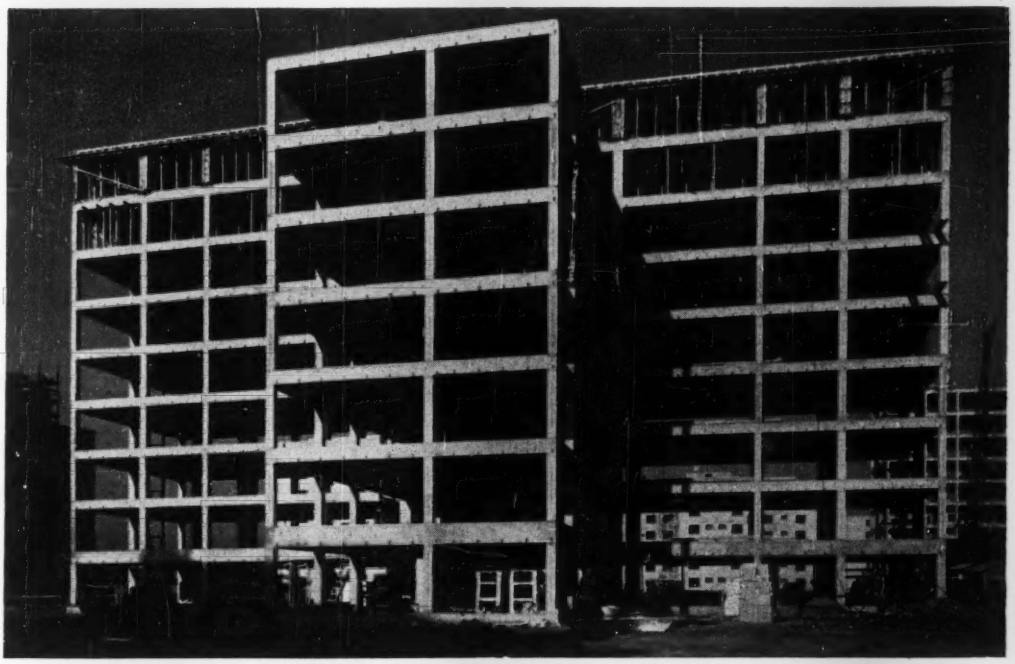
Despite a 6 percent drop in the primary aluminum production of the country in September, due to power shortages in the Northwest, the third-quarter output topped that for the second quarter by more than 6 percent, according to Donald M. White, secretary of the Aluminum Association.

The September production of 138,857,530 lb, which was almost 9,000,000 lb under the August output, brought the total for the third quarter to 431,883,793 lb and for the first three quarters of the year to 1,239,065,517 lb. These figures represent increases of 16.1 and 17.4 percent, respectively, over the corresponding totals for 1950. "Despite the expanded production," Mr. White said, "supplies for civilian use remain as tight as before because of increased government requirements."

UPADI Announces Formation of Board of Direction

Announcement of the formation of a Board of Directors for the Union Panamericana de Asociaciones de Ingenieros (UPADI) for the three-year period, 1951–1954, is announced from the temporary headquarters of the organization at Montevideo, Uruguay. They are Luis Giannattasio, Uruguay, president; James A. Todd, United States, vice-president; and Manuel J. Puente, Cuba, treasurer. Representatives on the board are Luis V. Migone, Argentina; Saturnino de Brito, Brazil; James A. Vance, Canada; Mario Lenzi, Colombia; Hector Butter, El Salvador; and Federico Boquin, Honduras.

UPADI held its first meeting in Havana in 1951 and agreed on a draft constitution, which was to govern until the next meeting to be held in New Orleans in the late summer of 1952. EJC has received the approval of a majority of its member bodies to become an adherent of UPADI (October 1951 issue, page 61).



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REINFORCED concrete frame and floor construction offers three important *plus* features to architects, engineers, contractors, owners and investors.

First, concrete frames and floors effect substantial savings in construction costs. This type of construction can lower the cost of frames and floors from 25% to 40% under the cost of other types of construction.

Second, concrete frames and floors save construction time. Inasmuch as frame and floor construction proceeds together as a unit, the masons, plumbers, electricians and other tradesmen can do their part of the job as the structural work progresses.

Third, concrete frames and floors allow maximum latitude in design. There is a concrete floor system to meet every occupancy requirement. Partitions can be placed where they are most desirable because framing can be adapted to any architectural layout. Concrete frames and floors can be designed for any structural requirement or for any type of job. They are ideally adapted to schools, hospitals, apartments, hotels, factories, stores and office buildings.

Dearborn Homes (above) in Chicago on State Street between 26th and 30th Streets is a typical example of concrete frame and floor construction. This apartment project consists of 800 units in 16 buildings. Four buildings are 9 stories and 12 are 6 stories in height. Loebl, Schlossman & Bennett are the architects, Frank A. Randall & Sons the structural engineers and S. N. Nielsen Co. the contractor.

Our technical staff will gladly help architects and engineers attain the highest quality concrete and the maximum structural advantages of reinforced concrete construction for any building project.

Write for two free booklets: "*Continuity in Concrete Building Frames*" and "*Handbook of Frame Constants.*" Distributed only in the U.S. and Canada.

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A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

Welded Bridge Award Program Announced

To encourage steel savings in bridge construction during the present emergency the Lincoln Arc Welding Foundation is sponsoring a 1952 Award Program, "Welded Bridges for Steel Conservation." The program is open to all persons in the United States who feel themselves qualified to enter and offers fifteen awards totaling $16,000. The first award is $7,000, the second award $3,500, and the third award $2,000. In adddition, there are twelve honorable mention awards of $300 each. Awards will be made on the basis of the best bridge designs showing weight and cost savings over comparable riveted bridges. The program allows entrants complete freedom as to size and type of bridge to be designed since the percentage of saving is the important factor to be judged.

Rules for the program have been formulated by fourteen of the nation's leading bridge engineers, five of whom will serve as the jury of award under the chairmanship of James G. Clark, Assoc. M. ASCE, professor of civil engineering at the University of Illinois. Copies of the rules and conditions are available from the James F. Lincoln Arc Welding Foundation, Cleveland17, Ohio.

Defense Program Affects Demand for Engineers

The effect of the defense program on the employment outlook for engineers is reported in a recent bulletin of the Bureau of Labor Statistics of the U.S. Department of Labor. One of a series of reports made available through the Bureau's Occupational Outlook Service for use in vocational counseling of students, veterans, and others, the report supplements and brings up to date the discussion of employment trends in the Bureau of Labor Statistics Bulletin No. 968, *Employment Outlook for Engineers*, which was written in 1949. An immediate nationwide need of over 30,000 engineers in the tooling up and development stage of the defense program is indicated.

Requests for the Supplement to Bulletin 968 should be addressed to the Bureau of Labor Statistics, U.S. Department of Labor, Washington 25, D.C.

Apprenticeship Training for Construction Workers Urged

Despite the fact that 2,791,000 workers are now employed on construction projects, including the building of defense production plants and housing in industrial centers, there is urgent need for many more thousands of workers in the industry to meet defense production needs. These facts were revealed by W. F. Patterson, director of the U. S. Labor Department's Bureau of Apprenticeship, at a recent apprenticeship completion ceremony in Madison, Wis.

"In view of the fact that the mobilization of workers is just under way, any let-down in training in the construction industry is unthinkable," Mr. Patterson asserted. He urged contractors to expand their work forces t rough apprenticeship and other forms of industrial training, and explained the service of the Bureau of Apprenticeship in assisting industry to establish programs for training apprentices for craftmanship in the skilled trades as well as for jobs requiring limited skill. The term "skill improvement" programs, he said, has been adopted by the Bureau to include the training for production jobs not requiring the versatility of all-round skilled workers.

Neare's N. G. COLUMN

R. Robinson Rowe, M. ASCE

"The answer," said Joe Kerr, "is simply terrible."

"The answer to what?" asked Professor Neare.

"Your silly question about Hy Drone's canal, of course. To make velocity independent of stage, the canal's section had a constant hydraulic radius, R, for areas exceeding $A = 1.0$ sq ft. For this area, the maximum R is $1/\sqrt{2\pi}$; for the full section, $A = 100$, so its perimeter, P, is $100\sqrt{2\pi} = 250.66$ ft and mean depth about 0.4 ft. You asked 'What shape was the canal in?' and I answer 'simply terrible.' Sort of a sway-backed swale with a sump down the center."

"That's the general idea, Joe. However, without condoning Hy Drone's half-witted brainchild, I wanted a better picture of its shape."

"I have it," said Cal Klater. "As Joe said, R is constant in $A = RP$, so for a section symmetrical about the Y-axis:

$$dA = R\,dP$$

$$2x\,dy = R(2ds) = 2R\sqrt{dx^2 + dy^2} \quad . \quad . \quad . \quad (1)$$

$$dy = R\,dx/\sqrt{x^2 - R^2}$$

$$x/R = \cosh y/R \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$dA = 2x\,dy = 2Rx\,dx/\sqrt{x^2 - R^2}$$

$$A = 2R\sqrt{x^2 - R^2} + C \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

"Joe was also right in taking $R = 1/\sqrt{2\pi}$ for the low-water section with unit area, which is semicircular to a radius of $2R$. Since the upper section has to join this semicircle on its diameter, we can substitute $A = 1$, $x = 2R$ and this value of R in (3) to find $C = 1 - \sqrt{3}/\pi$. For the canal width, we have $A = 100$ when $x = {}^1/_2 b$, whence

$$b = \sqrt{19{,}602\pi + 396\sqrt{3} + 8/\pi} = 249.5394 \text{ ft}$$

and the maximum depth will be 2.841 ft. Of course, the semicircle could have been hitched to the lower limb of Eq. 2, but the combination (Fig. 1*b*) could hardly be built as a canal."

"Neither could the third answer," added Ken Bridgewater, "but it's just as novel and simply as terrible. Eq. 1 is satisfied by $dx = 0$, $x = R$, which can be hitched to the semicircle by using a short section of Eq. 2, as in Fig. 1*c*. The combination is a canyon 0.80 ft wide and 124.71 ft deep!"

"Similarly," concluded the Professor, "for the infinitude of sections represented by Fig. 1*d*, in which the up-ended catenary of Eq. 2 is interrupted at its vertex by an indefinitely long segment of the line $x = R$. Fig. 1*a* was Hy Drone's fantasy. And now, promising something appropriate for Xmas Eve, an old friend will play Guest Professor again."

"I only promised a story of a Xmas present," answered Professor Stoop Nagle, "the set of blocks all gismoid in shape and an inch high that Archie Teck gave to little Archie. Trying to pile block on block at random, the boy soon learned that the upper block had to cover a little red dot on the lower block; otherwise it always toppled off. Suppose he tried to pile a third block on top of a stable pair by the same rule, how often would the pile collapse?"

[*Cal Klaters were: Ed C. Holt, Injun Ear (Hamilton Gray), Flo Ridan (Charles G. Edson), Stoop (John L.) Nagle (also the Guest Professor), Hi Drawly Cuss (Leland S. Rhodes), and Don'T (Donald Thayer). Also acknowledged are solutions to the hare-razing September problem from Rudolph W. Meyer and Laurence V. Degnan.*]

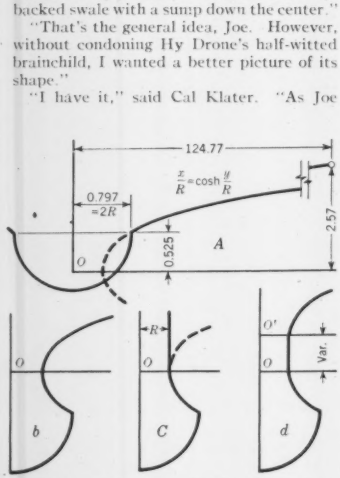
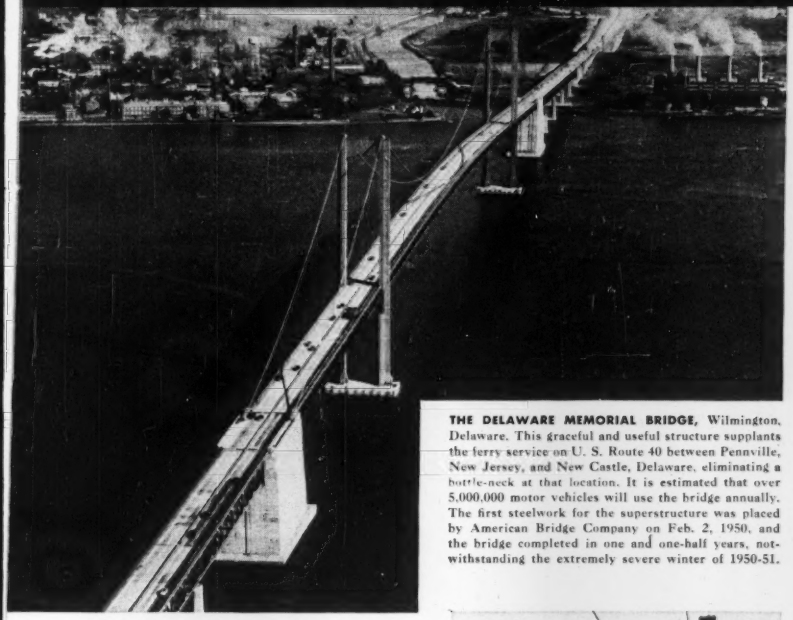


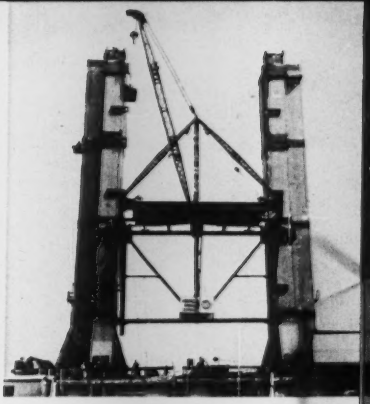
FIG. 1. HALF SECTIONS of constant hydraulic radius.

WORLD'S SIXTH LONGEST SPAN

Another outstanding example of American Bridge ingenuity and dependability



THE DELAWARE MEMORIAL BRIDGE, Wilmington, Delaware. This graceful and useful structure supplants the ferry service on U. S. Route 40 between Pennville, New Jersey, and New Castle, Delaware, eliminating a bottle-neck at that location. It is estimated that over 5,000,000 motor vehicles will use the bridge annually. The first steelwork for the superstructure was placed by American Bridge Company on Feb. 2, 1950, and the bridge completed in one and one-half years, notwithstanding the extremely severe winter of 1950-51.



ERECTION OF ONE of the two identical towers has progressed to the fourth section. Preparations are being made to "jump" the creeper to the next level. Completed towers rise 417 feet above the foundations—a height approximately that of a thirty-five story building.

HAVING FOUR traffic lanes, each 12 feet wide, a 3-foot median strip, and two 3-foot sidewalks, The Delaware Memorial Bridge provides a safer, speedier connecting link between the states of Delaware and New Jersey. The 2,150-foot main suspension span gives a vertical clearance of 175 feet above the 1,500-foot channel, sufficient for even the largest ships.

American Bridge Company fabricated and erected the steel superstructure, fabricated the steelwork for the anchorage foundations, and for the tower caissons, and spun the heavy suspension cables.

The complete story of American Bridge Company's part in the building of this great bridge has been published in an interesting new booklet. Contains many photographs showing various stages of construction. Write for your copy.

CATWALK VIEW from one of the main towers as wire is being spun into suspension cables. Pencil-thick wires, four at a time, are shown being carried across the Delaware River by a four-foot spinning wheel. Bridgemen are placing the wires in strands as they come from the wheel. The spinning operation continued day and night, interrupted only by high wind and severe cold.

INTERESTING FACTS THE DELAWARE MEMORIAL BRIDGE

Length of Main Suspended Span	2,150'
Length of Each Suspended Side Span	750'
Total Length of Suspended Spans	3,650'
Length of Delaware Approach	3,770'
Length of New Jersey Approach	3,087'
Total Length of Bridge between Abutments	10,765½'
Total Estimated Weight of Superstructure	73,141,500 #
Height of Towers Above Piers	417'
Size of Main Cables	19¼" Dia.
Size of Wire Suspenders	2" Dia.
Size of Hand Ropes	1" Dia.
Weight of Main Cables	6,978,000 #
Total Length of Suspender Cable	56,000'
Length of Hand Rope	15,200'
Total Estimated Cost of Bridge	$43,900,000

Owner:
Delaware State Highway Department

Engineers:
For the Delaware State Highway Department—
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Consultants:
O. H. Ammann
Moran, Proctor, Freeman & Mueser

Consulting Architect:
A. Gordon Lorimer

Superstructure:
Fabricated and Erected by American Bridge Co.

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USS

AMERICAN BRIDGE

UNITED STATES STEEL

NEW IN EDUCATION

Scientists at the Armour Research Foundation of the Illinois Institute of Technology are using the new 100-percent humidity curing room to study stronger, cheaper, lighter concrete blocks for future homebuilders. An air-conditioned, constant-temperature room, a preparation room, special concrete mixer, block-making machine, and testing equipment are also employed to make blocks that will meet government specifications for safe building materials. A light-weight aggregate, developed at the Foundation from expanded clay and shale, will be used to make building blocks weighing less than 30 lb—sand and gravel blocks currently in use weigh 50 lb.

* * *

A $126,000 grant to Duke University will endow a chair of learning and scholarship in the College of Engineering. To be known as the Jones Chair of Engineering, the endowment was created in honor of the late J. A. Jones, founder of the J. A. Jones Construction Co. Income from the fund will be used to pay all or part of the salary of the dean of the College of Engineering and to give scholarship assistance to qualified students in the college. William H. Hall has been dean of the College of Engineering since its founding in 1938.

* * *

The first in a series of planned ground-water courses was presented recently at the University of Wisconsin by a staff of senior engineers connected with the Ground Water Branch, Water Resources Division, U.S. Geological Survey, under the direction of Garald G. Parker, senior geologist. Changes in the science of ground-water hydrology, the need for investigations, and the lack of trained personnel necessitated the course. Such topics as the history and professional and scientific work of the U.S.G.S., public relations, instruments and methods, ground-water hydraulics and geology, and report writing were discussed.

DECEASED

Thomas Rupe Beeman (M. '12) for the past 14 years chief of the Relocations Branch in the Pittsburgh, Pa., District office of the Corps of Engineers, died on September 27. He was 70. Mr. Beeman was first employed by the Southern Pacific and the Chicago, Milwaukee & St. Paul railroads. From 1919 to 1937 he was successively resident engineer for the Washington State Highway Commission; chief engineer for the Regional Planning Commission of King County (Washington); and city engineer for Seattle, Wash. He graduated from Texas A. & M. College.

Thomas R. Beeman

Elisha Adolphus Blanpied (Assoc. M. '24) retired engineer of Kansas City, Mo., died on August 18, at the age of 69. Mr. Blanpied's experience included work as chief engineer for the Patent Steel Jetty Co., at Topeka, Kans.; secretary for the Aetna Investment Co., in St. Louis, Mo.; and field engineer and safety engineer for the Kansas City Bridge Co. He was educated at the University of Kansas.

Alfred V. Bowhay (Assoc. M. '32) civil engineer in the Bureau of Engineering of the San Francisco Department of Public Works, San Francisco, Calif., died on September 25, at the age of 65. For many years Mr. Bowhay had charge of the design of streets and highways in San Francisco. He then became traffic engineer for the Department of Public Works and since 1939 had been assistant to the city engineer. He also served as engineering representative to various joint county highway districts. He attended the University of California.

Horace Corey Booz (M. '14) retired engineer of Wynnewood, Pa., died on March 14. He was 75. In 1896 Mr. Booz entered the employ of the Pennsylvania Railroad, which he served as division engineer, assistant engineer, principal assistant engineer of branch lines, and assistant chief engineer. Later he was for some years chief engineer for the Berwind-White Coal Mining Co., general manager for the Berwind Land Co., and general manager for the Wilmore Coal Co., all of Philadelphia. He was a graduate of Lafayette College.

Benjamin Ross Brown (M. '23) vice-president and chief engineer for the Dallas Railway & Terminal Co., at Dallas, Tex., died there on October 5. His age was 66. At the outset of his career Mr. Brown worked for several railroads, including the Southern Pacific, and was construction engineer for the Stone & Webster Engineering Corp., at Houston, Tex. He had been associated with the Dallas Railway & Terminal Co. for 43 years. As chief engineer, he directed the design and construction of the transit viaduct between Dallas and Oak Cliff. He graduated from the University of Illinois.

Robert Paul Buettner (Jun. M. '45) architect-engineer of Dayton, Ohio, died on July 21. He was 31. Mr. Buettner was connected with W. Ray Yount, prior to establishing the firm of Robert P. Buettner, Architect and Engineer, at Dayton. He received degrees from Cincinnati and Illinois universities and the Illinois Section Award of Junior Membership in the Society.

Max Lawrence Button (Assoc. M. '21) for a number of years president of the John L. Goss Corp., at Boston, Mass., died recently, at the age of 61. Upon his graduation from the University of Vermont in 1911, Mr. Button entered the employ of the U.S. Coast & Geodetic Survey. Later he was successively engaged by the John L. Goss Corp., at Stonington, Me.; the Aberthaw Construction Co. in Massachusetts; and Lockwood, Greene & Co., in the New England area and New Jersey. Later he was connected with M. H. Merrill & Co., at Boston.

John Callaghan (M. '06) of Edmonton, Alberta, Canada, died on September 3. His age was 83. Mr. Callaghan devoted his entire career to railroad engineering work, serving the Columbia & Western and the Great Northern railways, and others throughout the United States and Canada. For some years he was division engineer and head of the construction department for the Canadian Pacific.

John Patrick Connelly (Jun. M. '44) of Dayton, Ohio, was killed in an airplane crash near Duluth, Minn., on September 9. He was 30 and a University of Cincinnati graduate, where he had been a member of the Student Chapter. During World War II he served in the Army Coast Artillery Corps.

Lewis D. Rights, Former ASCE Director, Is Dead

Lewis Daniel Rights (M. '08) former ASCE Director (1917–1919) and retired bridge and railroad engineer of Roselle, N.J., died on October 30. His age was 80. Mr. Rights began his engineering career doing pioneer railroad work in the West and Middle West. Subsequently he was with the Berlin Iron Bridge Co. in East Berlin, Conn., and the Pencoyd Iron Works in Philadelphia. From 1906 to 1934 he was with the Shoemaker Bridge Co., at Pottstown, Pa., retiring as vice-president and general sales engineer. He then formed a consulting practice in partnership with his son, Theodore B. Rights.

Lewis D. Rights

(*Continued on page 80*)

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INFORMATION SENT ON REQUEST. AMERICAN ROAD BUILDERS' ASSOCIATION. INTERNATIONAL BUILDING, WASHINGTON 4, D.C.

Deceased

(*Continued from page 78*)

Henry Alton Crandell (Assoc. M. '48) since 1947 commissioner of streets and sewers for Kansas City, Mo., died on March 12, though word of his death has just reached Society Headquarters. He was 58. Early in his career Mr. Crandell worked as contracting engineer for the Goldberg Structural Steel Co., and later was connected with J. L. Jacobs & Co. and the Army Corps of Engineers. He also engaged in private contracting work for 12 years. In 1946 he became structural engineer in the building inspection division for Kansas City, Mo.

Horace Holmes Chase (M. '12) retired civil engineer of Sandwich, Mass., died there on October 25, at the age of 75. At the start of his career Mr. Chase worked for the City of Brockton, Mass., and from 1905 to 1923 was principal assistant to F. A. Barbour, consulting engineer in Boston. He then became affiliated with Nicholas S. Hill, Jr., New York City consultant. In 1934 he retired as a member of the firm of Nicholas S. Hill.

Frederic Elwin Everett (M. '27) for several years New Hampshire State Highway Commissioner, at Concord, died on September 18. His age was 75. In 1906 Mr. Everett joined the New Hampshire Highway Department as assistant engineer, successively becoming division engineer in 1911 and state highway commissioner in 1915. Earlier he has been connected with the New England Telephone Co., and the Cambridge, Mass., Water Works, and Park Department. He received his training at Massachusetts Institute of Technology.

Edwin Clifford Finley (M. '09) civil and structural engineer of Tupelo, Miss., died on July 20. He was 85. At the outset of his career Mr. Finley was connected with the Cincinnati & Lenoir City, the Mobile & Ohio, and the Memphis & Birmingham railroads, and the U.S. Geological Survey. He later became assistant engineer for the Southern Pacific Railroad, engineer and superintendent of railroads for the Louisiana Purchase Exposition, and engineer for the Mississippi Railroad Commission. For some time he was president and engineer for the Itawamba Engineering Co. He was educated at the University of Mississippi.

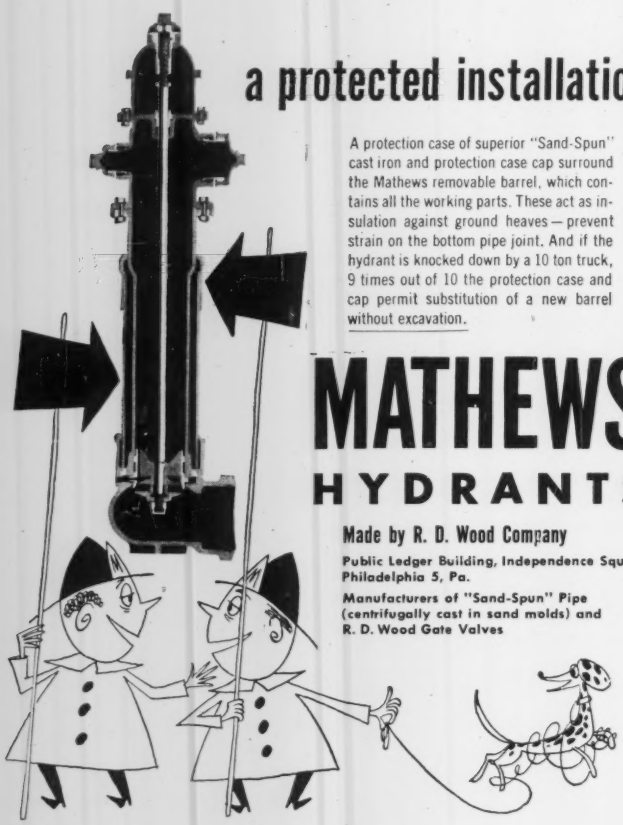
Charles Newton Green (M. '17) retired engineer of Utica, N.Y., died on October 30, at the age of 89. Upon his graduation from Cornell University in 1888, Mr. Green entered the employ of the Groton (N.Y.) Bridge Co. as assistant engineer. He was subsequently engaged by the Berlin Bridge Co., the Pennsylvania Steel Co., and other steel companies and consultants in Pennsylvania and New York. He had also been with the New York City Rapid Transit Commission and the Public Service Commission.

Fred Earle Hale (M. '29) for a number of years civil engineer for the Commonwealth & Southern Corp., at Birmingham, Ala., died recently. He was 65. During his career Mr. Hale was connected with Allied Engineers and the Alabama Power Co., having charge of construction work for the latter organization from 1931 to 1939. He was a University of Wisconsin graduate.

Fred Willis Haselwood (M. '23) retired highway engineer of Redding, Calif., died on October 27. His age was 71. Joining the California State Division of Highways in 1912, Mr. Haselwood served as division engineer at Redding from 1932 until his retirement in 1950. He had also been assistant district engineer for the Division at Willets and Eureka, and assistant bridge engineer and district engineer at Sacramento. He received his education at Kansas State College and Stanford University.

Meyer Hirschthal (M. '28), consulting engineer of New York City, died on October 15. He was 72. Mr. Hirschthal had been with the Delaware, Lackawanna & Western Railroad for 42 years, retiring in 1950. As concrete engineer, he designed many structures for the railroad, including the Delaware River and Tunkhannock viaducts. He also served as consultant for other organizations and was special lecturer on engineering subjects at Columbia University and director of the American Concrete Institute. He was educated at C.C.N.Y. and Columbia University.

John Benedict Klunk (M. '38) retired civil engineer of Toledo, Ohio, died on September



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24, at the age of 81. Early in his career Mr. Klunk worked for the Toledo Engineering Department and was deputy county surveyor for Lucas County, Ohio. Later he served various asphalt paving companies in Ohio and Pennsylvania, and for a number of years was vice-president, general manager, and chief engineer for the Continental Bitumen Co.

Henry Gay Livesay (Assoc. M. '19) retired engineer of Louisville, Ky., died October 8. He was 70. Mr. Livesay had taught surveying and civil engineering at Lehigh and Texas universities and was connected with the Virginia Bridge & Iron Co., at Roanoke, Va., and the Chicago, Milwaukee & St. Paul Railroad. For 35 years he was with the Louisville & Nashville Railroad, at Louisville, Ky. He graduated from Lehigh University.

James Lyle Olsen (Jun. M. '50) of Madison, Wis., was fatally stricken with poliomyelitis on October 5, while on active duty with the Corps of Engineers in the Philippine Islands. He was 23 and a civil engineering graduate of the University of Wisconsin. Before entering the service, Mr. Olsen was associated with the U.S. Geological Survey, at Champaign, Ill.

Robert Isham Randolph (M. '20) retired consultant of Santa Barbara, Calif., died on October 18. He was 68. A specialist in the fields of municipal, sanitary, and hydraulic engineering, Mr. Randolph was responsible for many public improvements in the Chicago area. He was connected with the Chicago Sanitary District, the Internal Improvement Commission of Illinois, and the Chicago Century of Progress Exposition. He served with the Army in both wars and held the rank of colonel. He also did private consulting work for the Mississippi Valley States and foreign countries.

Frank Thomas Sheets (M. '20) president of the Portland Cement Association in Chicago, Ill., died on November 3, at the age of 61. Mr. Sheets went to the Portland Cement Association as consulting engineer and director of development in 1933, becoming president of the organization in 1937. For 12 years he served the Illinois State Highway Department as superintendent of highways and later was chief engineer. Active in Society affairs, he was a past-president of the Central Illinois Section. He received his training at the University of Illinois.

Frank T. Sheets

Charles Aloysius Petry (M. '22) for several years general contractor and member of the firm of King & Petry, at Champaign, Ill., died recently. His age was 65. During his career Mr. Petry had been successively, junior engineer for the Illinois State Highway Commission; structural designer and superintendent of construction for Swift & Co., at Chicago, Ill.; and structural engineer and general superintendent of construction for the University of Illinois, at Urbana. He was educated at the University of Illinois.

Louis Blackmer Puffer (M. '37) professor of civil engineering and head of the engineering department at the University of Vermont, died on October 12, at the age of 65. Since 1921 a member of the University of Vermont faculty, Mr. Puffer was advanced to the rank of associate professor in 1925 and professor of civil engineering and head of the engineering department in 1933. He taught mathematics and surveying at Rensselaer Polytechnic Institute, his alma mater, from 1909 to 1920.

Frank Henry Stephenson (M. '15) since 1944 retired civil engineer of Worcester, Mass., died on October 3, at the age of 79. After graduation from Tufts College, Mr. Stephenson was employed by various municipalities, water and sewerage commissions, and consulting engineers in Massachusetts, Illinois, New York, and Ohio. He was assistant engineer, assistant superintendent, and engineer on water systems for the Department of Water Supply of Detroit, Mich., from 1919 to 1932. Later he served as engineering assistant for the Reconstruction Finance Corp. in Washington, D.C., and as associate engineer for the Tennessee Valley Authority, at Knoxville, Tenn.

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Signature..... Date.....

NEWS OF ENGINEERS

Gerald E. Arnold is on leave of absence from the City of San Diego, Calif., where he has been directing the water department, to accept the post of director of the Resources Division of the National Production Authority in Washington, D.C. As director, he will have charge of allocation of critical materials for all water works and sewer plants in the country. Active in Society affairs, Mr. Arnold has been serving as president of the San Diego Section, in which capacity he will be replaced by E. A. Lawrence. He was also chairman of the California section of the American Water Works Association.

Gerald E. Arnold

Billy T. Sumner has joined the Universal Concrete Pipe Co. as engineering representative in areas covered by the company's Nashville, Tenn., plant and the Dixie Concrete Pipe Co., at Louisville, Ky. Formerly he was resident engineer for Polk, Powell & Hendon, consulting engineers of Nashville. He has been serving as secretary-treasurer for the Nashville Section of the Society.

Billy T. Sumner

John C. Rehfield, formerly associate editor of Technical Publications for the American Society of Civil Engineers, is now associate editor of *Construction Equipment* in New York City. A graduate of City College of New York and Harvard University, Mr. Rehfield is currently serving as treasurer of the Harvard Engineering Society.

A. Clason Taylor, until recently director of the U.S. Bureau of Public Roads' Regional Highway Planning Survey for Greater Washington, has been transferred to Manila, P.I., where he will serve as division engineer for a two-year period.

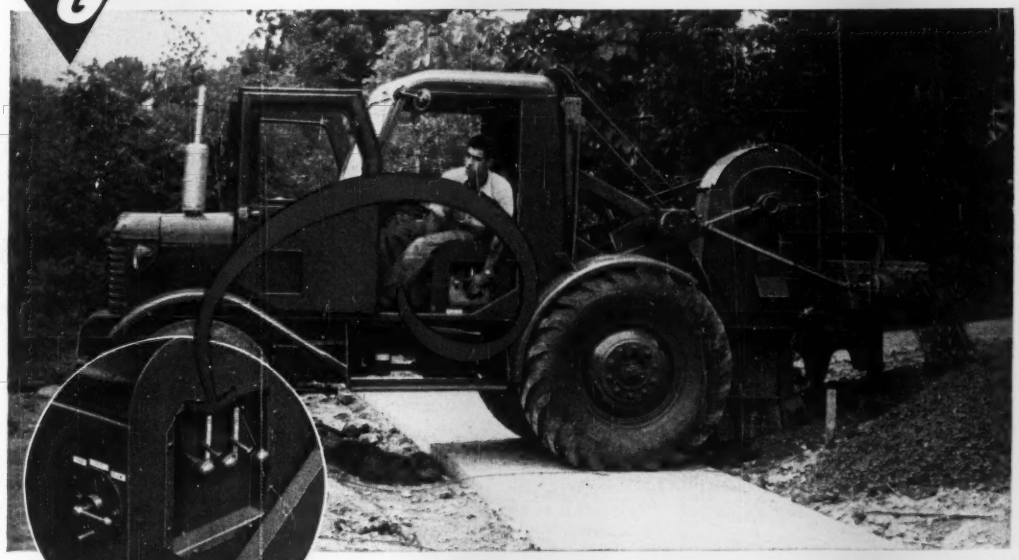
Haakon A. Abildso, structural engineer for E. I. du Pont de Nemours, Inc., of Wilmington, Del., has been appointed by the Delaware Society of Professional Engineers to a five-man committee that will study proposals to relieve traffic congestion in metropolitan Wilmington. **Louis H. Doane,** Wilmington consultant, has been named to the board that is to provide special information required by the committee.

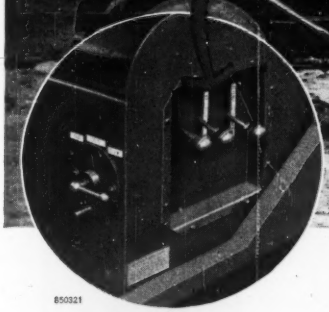
A. E. McCaskey, Jr., who recently resigned as chief of the Utilities Operations

(*Continued on page 84*)

Barber-Greene

Runabout SERVICE DITCHER





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finger-tip hydraulic control of crowding speed independent of bucket line speed

The Model 705-A Runabout now features the Hydra-Crowd, which provides an infinite range of crowding speeds from 0 to 16 f.p.m., independent of bucket line speed. With its 15 m.p.h. road speed and Vertical Boom milling action — and new Hydra-Crowd control — the Runabout combines mobility and digging efficiency to make possible lowest cost per foot of trench in all digging conditions the year around.

203

Outstanding Runabout Performance Features

- Year around operation
- 5½", 7½", 10½" cutting widths down to 48" deep
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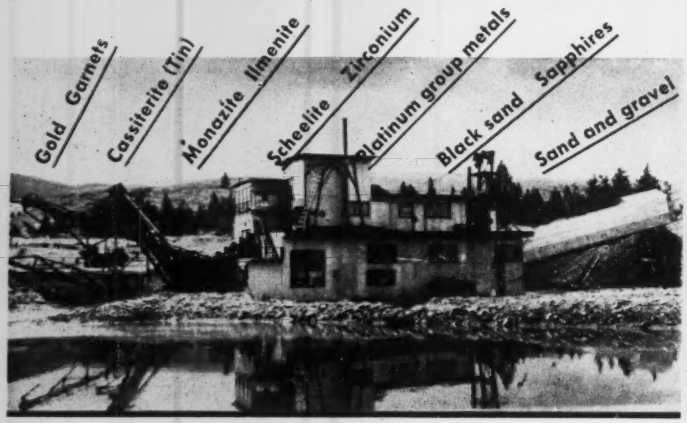

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News of Engineers

(*Continued from page 82*)

Branch in the Office of the Chief of Engineers, Washington, D.C., has been named professor and head of the department of engineering at Marshall College, Huntington, W.Va.

Alan W. Wolff, head of a civil engineering and surveying firm at Los Banos, Calif., has opened an additional office at 2846 Fulton Avenue, North Sacramento, Calif. At present the organization is engaged on a 165-mile mapping project of the San Joaquin and Kings rivers for the Corps of Engineers.

Russell E. Arnold, since 1948 chief engineer for Pacific Clay Products in Los Angeles, Calif., has accepted appointment to the position of director of research and development for the Robinson Clay Product Co., at Akron, Ohio. Mr. Arnold served the Robinson Clay Product Co. from 1928 to 1942 in research, engineering, and production capacities. He has also been chief engineer in charge of the sewer pipe division for Gladding, McBean & Co. in Los Angeles.

R. E. Arnold

Pecos H. Calahan, who retired in 1950 as executive secretary of the California State Board of Registration for Civil and Professional Engineers, has been appointed executive secretary of the Bay Counties Civil Engineers and Land Surveyors Association, Inc., with headquarters at Oakland. Mr. Calahan's duties will include coordination of the association's activities, particularly in the public relations field. He has been serving as secretary for the California Legislative Council of Engineering Organizations.

Harold W. Hunt is now resident engineer for F. R. Harris, Inc., of New York, on construction of the Portland, Oreg., dry dock center. Previously he was executive engineer for the Western Foundation Corp. in New York City.

Edward A. Merrill, with Skidmore, Owings & Merrill, of Chicago, Ill., has been transferred to Casablanca, French Morocco, where he is engaged on construction of air bases under the joint venture of Porter-Urquhart and Skidmore, Owings & Merrill.

George S. Salter, engineer of filtration design for the City of Chicago, Ill., has been appointed chairman of the public affairs committee of the Illinois Engineering Council.

Count Harvey, formerly construction management engineer for the Alaska District of the Corps of Engineers, is now senior structural engineer for Palmer & Baker, Inc., consulting engineers, of Mobile, Ala.

K. K. Nambiar, chairman of the Madras

(*Continued on page 89*)

What's Your IQ?

KERLOW IQ-35 STEEL BRIDGE FLOORING, as shown above, will carry H2O loading on a 15" circle up to a span of 48" and weighs only about 19 lbs. It is the safest, strongest flooring that KERLOW has ever made. KERLOW also makes superior gratings for bridges, highways, industrial plants... floors, slabs, armoring, sidewalks, safety steps, drain grates, trench covers, grid trays, tote boxes and pallets. Lighter in weight, stronger, with exclusive performance features. Before you specify, before you buy, write for documented, informative catalog that tells you why your first line of steel-grating supply is

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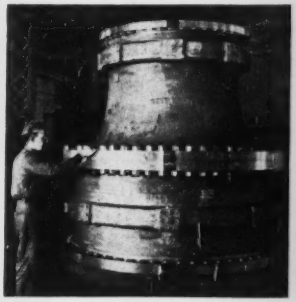

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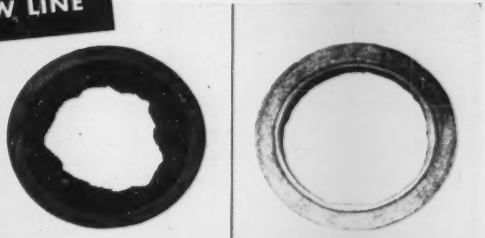

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Men Available

BRIDGE ENGINEER; Jun. M. ASCE; 33, married; graduate licensed civil engineer; 6 years' experience in bridge design with some field work; 2 years on buildings and dams; 1½ years on military construction. Desires position with consulting engineer or contractor. Prefers Northwest or Midwest. C-707-5110-A-5-San Francisco.

Positions Available

CIVIL OR MINING ENGINEER, 30–40, graduate, with some experience in road building and construction for field work. Knowledge of Spanish essential. Location Caribbean area. Y-6000.

ASSISTANT EDITOR for engineering society journal. Civil engineering graduate preferred with an aptitude for writing and editing technical literature. Salary, to start, $3,600–$4,000 a year, depending upon education and experience. Location, Michigan. Y-6094.

SANITARY ENGINEER, young with 3 to 5 years' experience handling waste-disposal problems in industry or with municipal background. Salary, $4,200–$5,400 a year. Location, Pennsylvania. Y-6099.

SANITARY ENGINEERS, 35–40, to design and draw up sewage systems and treating plants, etc., with knowledge of water producing and distribution. Should have about 10 years' practical experience in addition to a degree in sanitary engineering. Location, Virginia. Y-6120.

DESIGNER to handle airfield pavements for an extension of present airfield facilities to accommodate jet planes, including widening, lengthening, and strengthening existing runways and construction of new taxiways and aprons, etc., together with drainage and grading work. Location, Virginia. Y-6137.

TECHNICAL WRITER, young, civil graduate with interest in journalism and/or research of the market-analysis type. Will be responsible for news of equipment and materials used in the construction field and review catalogs and other manufacturer literature. Also involves market-analysis and research work, collecting data and preparing reports on the application of various products in the construction industry. Some experience in journalism, such as on college or engineering society paper or magazine desirable. Salary, to start, $3,500–$4,000 a year. Location, New York, N.Y. Y-6155.

EDITOR, civil graduate, for national trade publication concerned with civil engineering. Recent graduate will be accepted provided he has some previous college experience in editing. Salary open. Location, New York, N.Y. Y-6191.

CONSTRUCTION FIELD SUPERINTENDENT experienced in all phases of heavy industrial construction, to direct work on major construction projects. Will supervise division engineers. Location, Delaware. Y-6193.

SALES ENGINEERS with engineering degrees, young, with experience with a state highway commission helpful. Company fabricates and distributes to the highway and drainage fields such products as corrugated culvert, welded pipe, etc. Civil, mechanical, or an electrical engineer preferred, to start as sales correspondent or as a product development engineer and eventually work into field of sales. Some traveling involved later on. Must be citizens of the United States. Salary, $3,600–$4,800 a year. Location, Ohio. Y-6203(*b*).

ASSISTANT OR ASSOCIATE PROFESSOR of civil engineering, 35–50, with advanced degree and some teaching experience. Should be qualified in fields of soil mechanics and highway engineering. Salary, about $4,000–$4,700 a year. Location, New England. Y-6228(*b*).

(Continued on page 88)

STRUCTURAL DESIGNER WANTED

C.E. graduate major in structural design with 3 to 5 years' experience in design of steel and reinforced concrete structures and in general drafting room procedures. Experience in structural design in oil refinery or chemical industry desired.

Location Chicago. Salary up to $7200.

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by W. E. Wickenden

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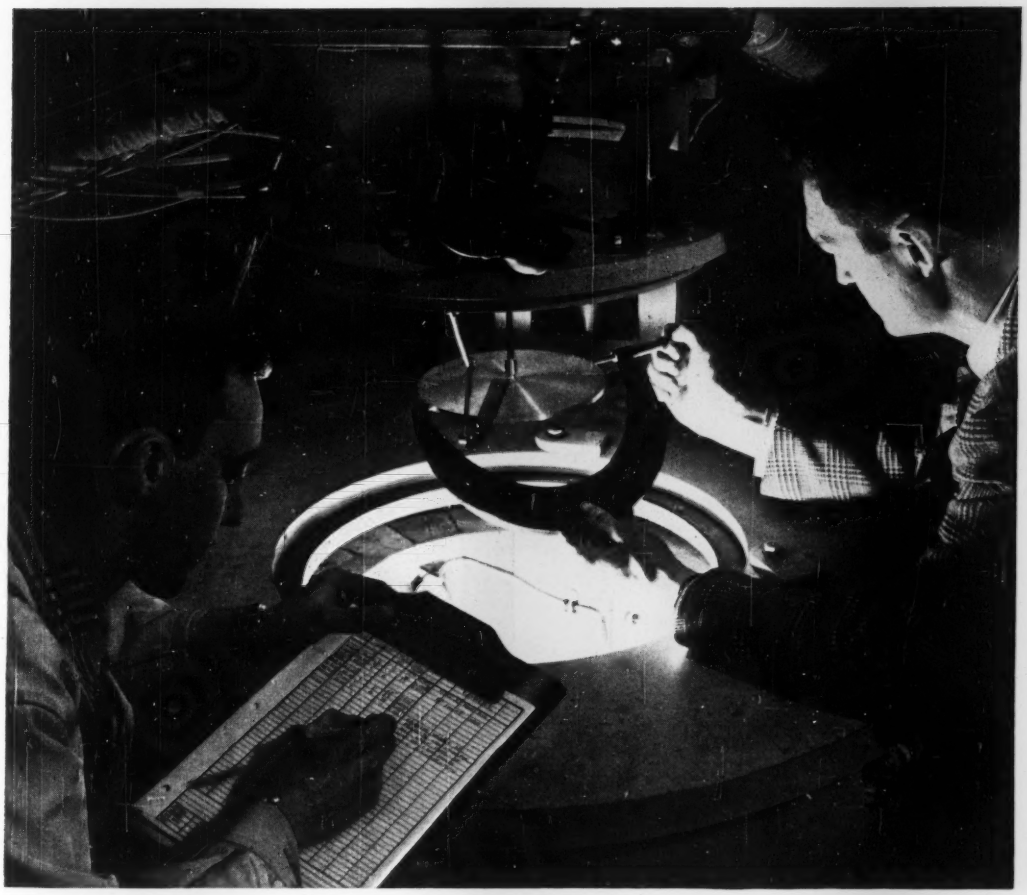

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BOEING

Positions Available

(Continued from page 86)

CONTRACT CONTROL ENGINEER, civil or structural, with civil engineering degree and extensive experience in contract and specification writing on concrete, steel, and general structural work. Knowledge of materials and equipment. Candidate will have to incorporate electrical, mechanical, plumbing, and heating factors into structural specifications. Should have at least 6 years' experience. Salary, $6,200–$7,700 a year. Location, New York, N.Y. Y-6229.

HYDRAULIC AND SANITARY DESIGNER, civil graduate, with at least 5 years' experience, to design land drainage, water-flow and sanitary systems. Also assist in scientific studies of water flow in towing tanks, etc. Salary, $6,000–$8,000 a year. Location, New York, N.Y. Y-6239.

DESIGNERS, with some experience in structural design, sanitary, water supply, architecture, plumbing and heating, and electrical work, for engineering organization. Salary plus bonus. Location, Illinois. Y-6240.

CIVIL ENGINEER, graduate, 25–35, to do technical promotional work in connection with building trades. Considerable traveling in the East. No selling. Knowledge of building codes desirable. Salary, $6,000–$7,200 a year. Location, New York, N.Y. Y-6246.

SENIOR ASSISTANT SANITARY ENGINEER, graduate, with degree in chemistry or sanitary engineering and 4 years' experience in chemistry or sanitary engineering or industrial or municipal waste disposal. Position involves the performance of responsible sanitary engineering work in developing and applying public health, sanitary engineering and water-pollution control measures. Salary, $4,140–$5,175 a year. Location, Maryland. Y-6248.

DRAFTSMAN, civil or mechanical, around 30; good experience in general plant engineering drafting, able to cope with simple structural calculations and layout. Will train for engineering job. Salary, $4,980–$5,760 a year. Location, Milwaukee, Wis. T-8359.

Positions Announced

Milwaukee County (Wisconsin) Civil Service Commission. Announcement of an examination for the position of Planner III, with monthly salary ranging from $434 to $524, is made by the Milwaukee County (Wisconsin) Civil Service Commission. To qualify for the examination, the applicant must be a graduate of an accredited college or university and have six years' experience in the general planning field. Full information may be secured from the Milwaukee County Civil Service Commission, Room 205, Courthouse, Milwaukee 3, Wis.

State of Washington. The Washington State Department of Health is seeking public health engineers and senior public health engineers, at monthly salaries ranging from $358–$486. Applicants must be graduate engineers with some experience in the sanitary or public health engineering field. Details and application forms may be obtained from the State Personnel Board, 1209 Smith Tower, Seattle 4, Wash.

U.S. Civil Service Commission. An examination for Highway Engineer Trainee, Grades GS-4 and GS-5, with yearly salaries from $3,175–$3,410, is announced by the U.S. Civil Service Commission. Persons selected for trainee positions will be offered the opportunity to participate in special training programs in the Bureau of Public Roads and to become acquainted with the work of the U.S.B.P.R. Address inquiries to the U.S. Civil Service Commission, Washington 25, D.C.

Meetings and Conferences

American Association for the Advancement of Science. A varied collection of tools and materials of science will be exhibited and discussed at the annual midwinter meeting of the American Association for the Advancement of Science, which will be held in Philadelphia, Pa., December 26–31.

Symposium on Nucleation. Sponsored by the Division of Industrial and Engineering Chemistry of the American Chemical Society, the Symposium on Nucleation will take place at Northwestern University, Evanston, Ill., on December 26 and 27.

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Positions are open in the engineering and design of complete oil-refineries and chemical-plants. Our expanding workload presents opportunities for advancement.

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News of Engineers

(*Continued from page 84*)

City Improvement Trust, Madras, India, has become chief engineer of highways for Madras State, with headquarters in Gandhinagar, Madras, India.

J. D. Hancock, engineer for the U.S. Bureau of Reclamation, has gone to the Middle East, where he will conduct water resources investigations in Lebanon, Syria, Jordan, Iraq, Iran and Egypt under the auspices of the Point IV Program. The regional mission is a Technical Cooperation Administration project to restore wide use of natural resources.

Fred Burggraf has been named director of the Highway Research Board of the National Research Council in Washington, D.C., succeeding the late **Roy W. Crum.** In highway research work since 1919, Mr. Burggraf has been connected with the National Bureau of Standards, the Illinois Division of Highways, and the Calcium Chloride Association. He served as research engineer for the Highway Research Board from 1928 to 1932, returning to the Board as assistant director in 1940 and becoming associate director in 1945.

Fred Burggraf

H. H. Roberts, formerly chief engineer for Consolidated Builders, Inc., on the construction of Bull Shoals and Detroit dams, has joined the Arundel Corp. as project manager on Liberty Dam, which is being constructed on the Patapsco River for the City of Baltimore Water Department. His headquarters will be in Baltimore.

Raymond J. Rosenberger recently resigned as head of the specifications department for Gannett, Fleming, Corddry & Carpenter, Inc., at Harrisburg, Pa., to become engineer of specifications for the J. E. Greiner Co., consulting engineers of Baltimore, Md.

R. E. Bakenhus, rear admiral (CEC) U.S. Navy (retired) and New York City consultant, represented ASCE at the Joint Engineering Conference in London held as a feature of the Festival of Britain—not at the World Engineering Congress as was erroneously reported in the November issue. Sponsored by the British Institution of Civil Engineers, the Institution of Mechanical Engineers, and the Institution of Electrical Engineers, the Joint Conference had for its aim publicizing the "contributions of the engineers and scientists of the country to the advancement of civilization."

Albert C. Ringelstein, formerly associated with Thompson-Starrett Co., Inc., as project manager on construction of the U.S. Naval Hospital at St. Albans, N.Y., has become connected with John W. Harris Associates, Inc., with headquarters in New York City.

C. Victor Thornton, president of the Steel

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The step up to Aircraft Engineering isn't as steep as you might expect.

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What's more, Lockheed trains you *at full pay.* You learn by doing—in Lockheed's on-the-job training program. When necessary, you attend Lockheed classes. It depends on your background and the job you are assigned. But, always, you learn at full pay.

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Living conditions are better in Southern California. The climate is beyond compare: Golf, fishing, motoring, patio life at home can be yours the year 'round. And your high Lockheed salary enables you to enjoy life to the full.

Note to Men with Families: Housing conditions are excellent in the Los Angeles area. More than 35,000 rental units are available. Thousands of homes for ownership have been built since World War II. Huge tracts are under construction at Lockheed.

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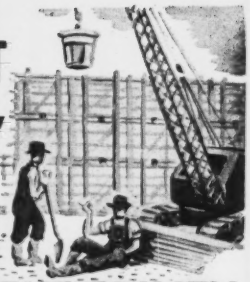

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News of Engineers

(*Continued from page 89*)

Engineering Co. of Forth Worth, Tex., announces that the name of the firm has been changed to the Thornton Steel Co. In addition to the industry in Fort Worth, Mr. Thornton is president of the Western Steel Co. in Corpus Christi.

William N. Woodbury, assistant chief engineer for the Virginia Bridge Co., at Birmingham, Ala., announces the opening of an office for the practice of consulting engineering at 1102 South 20th Street, of that city.

Charles H. Neel, commander, CEC, U.S. Navy and since 1949 a member of the faculty at the Industrial College of the Armed Forces in Washington, D.C., is now public works officer at the U.S. Navy Base in Newport, R.I.

Roy A. Nyquist has been named chief engineer for the Libbey-Owens-Ford Glass Co., at Toledo, Ohio. On the engineering staff of the organization since 1934, Mr. Nyquist has been assistant chief engineer for the past seven years.

Willard Chevalier, executive vice-president of McGraw-Hill Publishing Co., Inc., of New York, N.Y., was elected member-at-large by the American Standards Association at its recent three-day standardization conference in New York City.

W. E. Gilbertson, sanitary engineering director and executive officer for the Communicable Disease Center of the U.S. Public Health Service, at Atlanta, Ga., has been designated chief of the U.S.P.H.S. Division of Civilian Health Requirements.

H. A. Beckwith, of Austin, Tex., has been reappointed chairman of the Texas Board of Water Engineers for a six-year term.

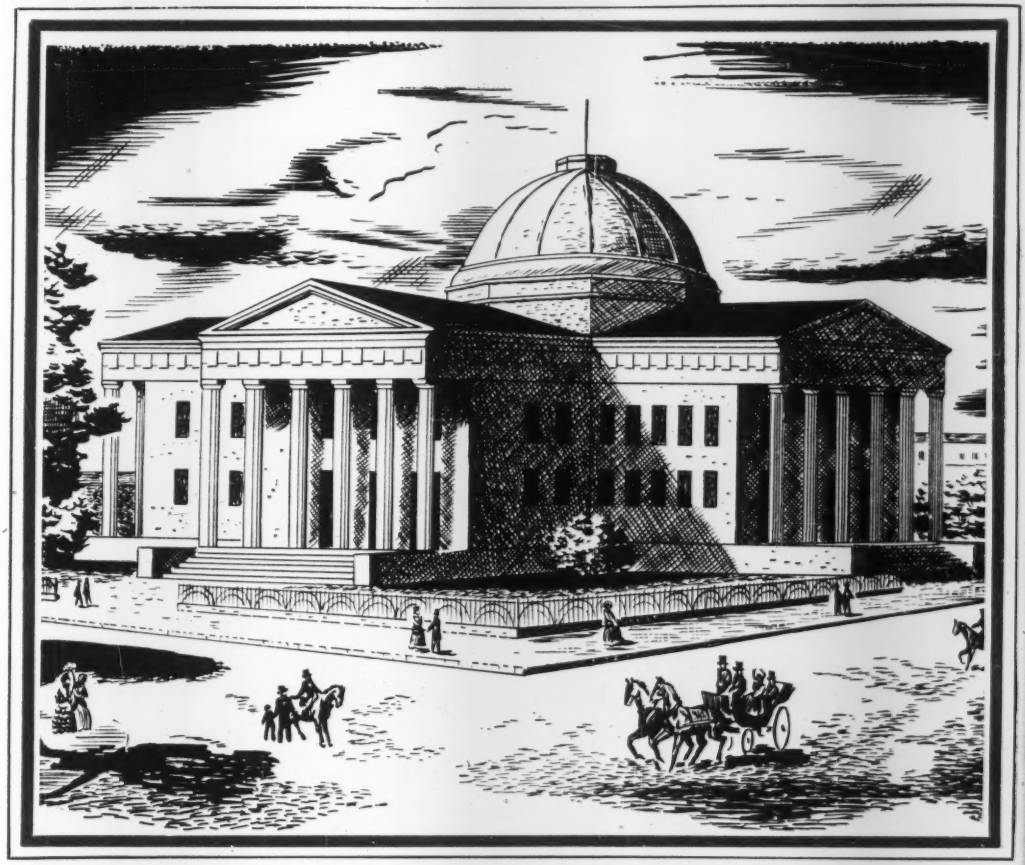
Howard E. Moses has received the Alvin Emerson Medal for outstanding services to the Federation of Sewage and Industrial Wastes Associations. This service was rendered in his capacity of consulting chief engineer to the Bureau of Sanitary Engineering of the Pennsylvania Department of Health, at Harrisburg.

Alfred C. Dildine, of Sacramento, Calif., has been recalled by the Navy and is serving in Hawaii.

Don M. Hoffman, colonel, Ordnance Corps of the Army, is now commanding officer at the Sunflower Ordnance Works, Lawrence, Kans.

J. R. Hoffert, chief engineer of the Bureau of Sanitary Engineering, Pennsylvania Department of Health, Harrisburg, has been presented the Arthur Sidney Bedell Award for his outstanding services to the Federation of Sewage and Industrial Wastes Associations.

Linton J. Murphy, professor of sanitary engineering at the University of Missouri, has gone to Germany for consultation with representatives of public health organizations on working out a modern sanitary engineering program.



The old courthouse in St. Louis as it looked 100 years ago

St. Louis, Missouri has a cast iron water main in service that was installed more than 100 years ago. That is not surprising as St. Louis is one of our oldest cities, founded by the French and taken over by the U. S. A. with the Louisiana Purchase. Yet this old main is still withstanding the traffic shock and beam stresses imposed by multi-ton trucks and congested underground utility services in a great manufacturing city. More than thirty other American cities have cast iron water and gas mains in service that were installed over a century ago—indisputable testimony to the strength factors of long life inherent in cast iron pipe.

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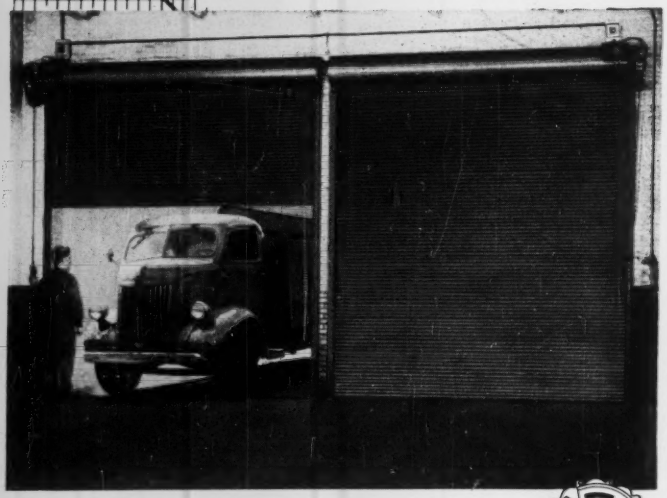

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New Publications

Glossary of Nuclear Terms. Availability of several preliminary sections in a projected *Glossary of Terms Used in Nuclear Science and Technology* is announced by the Office of Education of the Federal Security Agency. Under discussion since 1947, the glossary is being prepared and copyrighted by the National Research Council and printed and distributed by the American Society of Mechanical Engineers. Sections now obtainable from the ASME, 29 West 39th Street, New York, N.Y., are No. 3, "Reactor Engineering," 75 cents; No. 5, "Chemical Engineering," 60 cents; No. 6, "Biophysics and Radio-Biology," 60 cents; and No. 7, "Instrumentation," $1. Sections 4, 8, and 9—on "Chemistry," "Isotope Separation," and "Metallurgy"—are now in press, and Sections 1 and 2, covering "General Terms" and "Reactor Theory," are in the hands of review committees.

Automotive and Construction Equipment. In this 387-page illustrated textbook, entitled *Automotive and Construction Equipment*, C. W. Lindgren, special assistant for field activities with the Automotive and Equipment Division of the Bureau of Yards and Docks, gives basic information on the economical use and maintenance of different types of automotive and construction equipment. The work is especially planned for civil engineering, transportation and military personnel as well as for members of municipal, state and federal agencies having responsibility for the purchase and upkeep of such equipment. Copies of the book, which is priced at $4.50, may be obtained from the author Lt. Comdr. C. W. Lindgren, Box 3620, Washington D.C.7.

Stream-Bank Revetment. Cooperative studies of a pervious fence used as revetment for the banks of an open channel carrying sediment-laden flow—made at the Cooperative Hydraulic Laboratory of the U. S. Soil Conservation Service and the California Institute of Technology—are reported in SCS-TP-103. Inquiries concerning the 66-page illustrated publication, which was written by John T. O'Brien, Assoc. M. ASCE, former research hydraulic engineer for the California Institute of Technology, should be addressed to the Soil Conservation Service, Washington 25, D.C.

Refresher Course, Review. In the 1951 revision of his *Review of Structurdl Design for Professional Engineers License Examination*, S. W. Spielvogel, M. ASCE, has assembled material presented in twenty lectures given in preparation for the New York State Professional Engineer examinations. The subjects of stresses and materials are presented in condensed, but sufficiently complete, form to permit a review of the rudiments in minimum time. The publisher is the McGraw-Hill Book Co. 330 West 42nd Street, New York, N.Y., and the price $4.

Industrial Hydraulics. Proceedings of the 1950 National Conference on Industrial Hydraulics have been published by the Illinois Institute of Technology. Copies of the 347-page illustrated volume may be purchased from the National Conference on Industrial Hydraulics, the Illinois Institute of Technology, Chicago 16, Ill., for $4.50.

Snow Studies. Cooperative snow investigations, conducted by the Army Corps of Engineers and the U. S. Weather Bureau at the Central Sierra Snow Laboratory near Soda Springs, Calif., are outlined in Technical Report No. 4A of the Corps of Engineers. Inquiries concerning the report, which is entitled *Terrain Characteristics—Central Sierra Snow Laboratory Basin*, should be addressed to the South Pacific Division, Corps of Engineers, U. S. Army, San Francisco, Calif.

Nuclear Science Bibliography. Copies of a reference list of *Nuclear Science in Engineering Education*—sponsored by the Atomic Energy Commission, the American Society for Engineering Education, and the U. S. Office of Education—may be purchased from the Office of Technical Services, U. S. Department of Commerce, Washington, D.C., at 10 cents each. Prepared upon the recommendation of the ASEE Committee on Atomic Energy Education, the list is intended primarily for instructors.

Atomic Defense. How to protect industrial plants, large and small, against the destructive effects of atomic attack is explained in a 32-page illustrated booklet made available by Walter Kidde & Company, Inc. The booklet includes latest factural information on the bomb, its destructive potential and its limitations, and recommendations for strengthening plant construction and sustaining production in the face of bomb attack. Copies are available free of charge from Walter Kidde & Company, Inc., Dept. A., 675 Main Street, Belleville 9, N.J.

Concrete Standards. All current standards of the American Concrete Institute have been made available in *ACI Standards—1951*, except the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315). Because of its large format this standard is available only as a special publication, priced at $3. Each of the eleven standards included in the present 650-page volume is also available in separate reprint form. Copies of the 1951 standards may be obtained from the American Concrete Institute, 18263 W. McNichols Road, Detroit 19, Mich. Prices are $1.75 to ACI members, and $3 to all others.

Bituminous Construction. For the convenience of contractors, construction engineers, and others doing bituminous paving, the Barber-Greene Company has issued a revised and enlarged edition of its *Bituminous Construction Handbook*. The present edition grows out of increased demand for data on erection and operation of bituminous construction equipment assembled by the company for its own staff. Primarily a discussion of bituminous road construction methods and classifications, it sets forth objectives of good road construction. Free copies are available to engineers and contractors requesting them on business letterhead. To others the price is $2. Inquiries should be addressed to James E. Ward, Paving Engineer, the Barber-Greene Company, Aurora, Ill.

Highway Research. Recent publications of the Highway Research Board include Bulletin 38, containing the 1950 annual report of the Committee on Land Acquisition and Control of Highway Access and Adjacent Areas, and Bulletin 39, which describes recent developments in precasting concrete bridges and structures. Bulletin No. 38 sells for $1.20, and Bulletin No. 39 for 45 cents. Inquiries should be addressed to the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C.

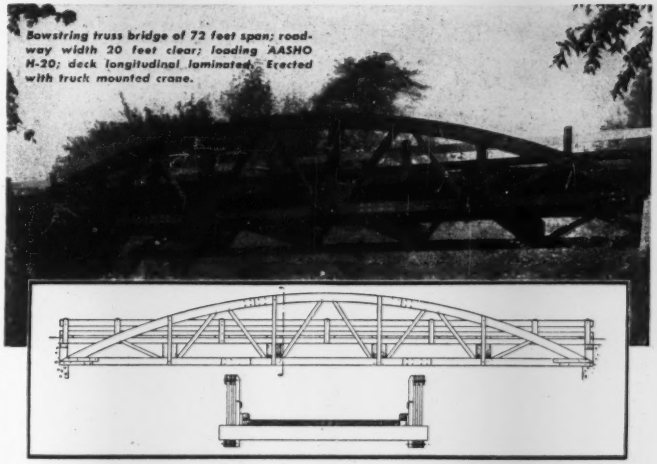
Stress Distribution Research. Studies of compressive stress distribution in simply reinforced concrete near the point of failure—conducted by Lester A. Herr, Jun. M. ASCE, and Louis E. Vandegrift, Assoc. M. ASCE, of the civil engineering department at Ohio State University—have been issued by the Engineering Experiment Station as Bulletin No. 144. Orders, accompanied by remittance of 50 cents for each copy, should be addressed to the Director, the Engineering Experiment Station, Ohio State University, Columbus 10, Ohio.

Government Contracts. A brochure, entitled "If You Want to Do Business with the Government," is offered by the *U. S. Government Advertiser*, free of charge, to persons writing to that publication at 511 Eleventh Street, N.W., Washington 4, D.C. The brochure tells briefly what is required of anyone seeking a federal defense or other government contract, and outlines difficulties and procedures connected with meeting a federal contract once it is signed.

Review Questions for Surveyors. Availability of a new compilation of review questions for surveyors is announced by the author, Russell C. Brinker, Assoc. M. ASCE, professor of civil engineering at Virginia Polytechnic Institute. The 109-page lithoprinted publication contains 1,575 questions of all types—multiple choice, completion, discussion, true and false, and problems—collected by the author over a period of twenty years. Sources include Civil Service and professional registration examinations as well as many deriving from the experience of the author and his colleagues. Orders for the book, which is $2 postpaid, should be sent to Professor Brinker, Box 323, Blacksburg, Va.

Road Base Materials. Results of triaxial tests on approximately 250 specimens of gravel, crushed stone, crushed slag, and sand, conducted by the

(*Continued on page 94*)



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New Publications

(Continued from page 93)

Civil Aeronautics Administration, are summarized in Technical Development Report N. 144 of the CAA. The authors are William M. Aldous, Raymond C. Herner, and M. H. Price, of the Airport Division. Inquiries should be addressed to the CAA at the Technical Development and Evaluation Center, Indianapolis, Ind.

Engineering Geology. For the benefit of United States engineers and geologists, the U. S. Geological Survey is making available translations from the French of five authoritative articles in the field. They are translations No. 21, "Application of Electro-Osmosis to the Execution of Certain Works on Water-Bearing Soils," by G. Remenieras; No. 22, "Soil Silification," by Albert Debecq; No. 23, "Determination of the Angle of Internal Friction and of the Cohesion of Soils in Situ by Means of Dynamic Drilling," by A. Courad; No. 24, "Electrical Treatment of Plastic Clay," by Y. Poisson; and No. 25, "Device for the Rapid Test in Situ of the Resistance of Foundation Grounds," by Rene Deguillaume. All have been placed in open file in Geological Survey offices in Denver, Colo., Washington, D.C., and other cities.

Torsion Shear Test. Announcement of a 70-page report on the results of torsion shear tests, made by the U. S. Waterways Experiment Station on samples of Atlantic muck, is made by the Army Corps of Engineers. The tests were performed with a new torsion shear apparatus, developed and built by the Waterways Experiment Station. The report, identified as Technical Memorandum No. 3-328, may be purchased from the Waterways Experiment Station, Vicksburg, Miss., at $1.

Control of Wartime Damage. World War II air raid experience in protecting workers, plant, and equipment can, with minor modifications, be made to fit atomic warfare conditions, according to a study on damage control in wartime recently released by the National Industrial Conference Board. Issued as Studies in Business Policy No. 53, the report may be obtained from the News Department of the National Industrial Conference Board, Inc., 247 Park Avenue, New York 17, N.Y. It is priced at $3.

Engineering Manpower. Proceedings of the recent Engineering Manpower Convocation, held in Pittsburgh under sponsorship of the Engineering Manpower Commission of EJC and the Engineers Society of Western Pennsylvania, have been made available in a recent EJC compendium. The same publication includes EJC bulletins, entitled "The Critical Shortage of Engineers," and "Utilizing Engineering Manpower."

Navigation Maps. Publication of the fifth edition of *Folio of Navigation Maps of the Intracoastal Waterway, Gulf Section, New Orleans, La., to Port Arthur, Tex.*, is announced by the Mississippi River Commission. Compiled from latest available data, the maps show such recent features as the Algiers navigation lock as well as plans and elevations of bridges and locks and details of port facilities. A profile of the Atchafalaya River is included. Copies of the folio, priced at $1 each, may be purchased from the Mississippi River Commission, Vicksburg, Miss., or from the New Orleans District, Corps of Engineers, Foot of Prytania Street, New Orleans 9, La.

City Planning. A thirty-year plan of action for the City of Cleveland, prepared by the City Planning Commission, is outlined in an illustrated brochure entitled *Cleveland Today—Tomorrow*. Copies and further detailed data on the plan are available on request from the Public Information Section, City Planning Commission, 501 City Hall, Cleveland 14, Ohio.

Flood Control. Studies of flood damage and flood-control activities in Asia and the Far East, carried out by the Bureau of Flood Control of the Economic Commission for Asia and the Far East, have been issued as Flood Control Series No. 1. The first in a projected series on the flood-control problem in Asia and the Far East, the present publication is based on data received from technical organizations in member countries of ECAFE submitted to the Bureau of Flood Control in response to a questionnaire. Copies may be purchased from sales agents for United Nations publications in all UN countries or from the Sales and Circulation Section, United Nations, Lake Success, N.Y., at $1.50 each.

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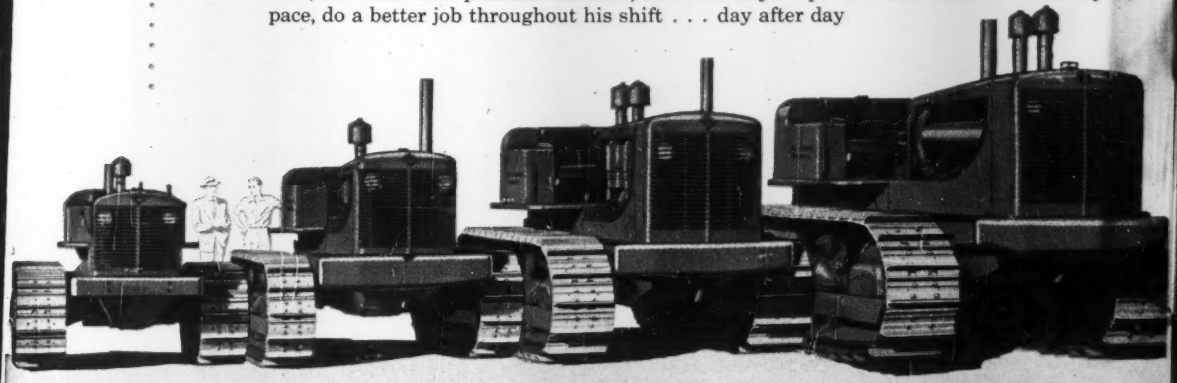

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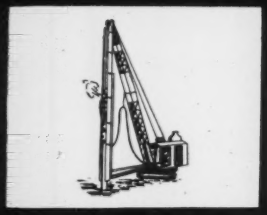

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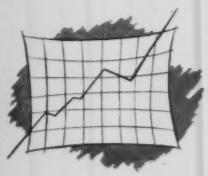

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RECENT BOOKS

ASTM Book of Standards, 1950 Supplements, including Tentatives.

These 1950 Supplements give in the latest approved form some 353 specifications, tests and definitions, which were either issued for the first time in 1950 or revised since the 1949 book. Part 1 includes ferrous metals; Part 2, non-ferrous metals; Part 3, cement, concrete, ceramics, thermal insulation, road materials, waterproofing and soils; Part 4, paint, naval stores, wood, adhesives, paper, and shipping containers; Part 5, textiles, soap, fuels, petroleum, aromatic hydrocarbons, antifreezes and water; and Part 6, electrical insulation, plastics and rubber. (American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1950–1951. $21 for complete set; $3.50 each.)

Deutscher Ausschuss für Stahlbeton, Heft 104
Bindemittel für Massenbeton, Untersuchungen über Hydraulische Bindemittel aus Zement, Kalk und Trass. By K. Walz.

A detailed report, with tables and sketches, of studies made at the Technical Institute of Stuttgart, Germany, between 1941 and 1949 on hydraulic binding media for cement, lime and trass for massive concrete construction. (Verlag Wilhelm Ernst u. Sohn, Berlin, 1951. 47 pages, 5.50 D.M.)

Engineering Design

This book, by J. E. Taylor and J. S. Wrigley, links the fundamental principles of strength of materials and allied subjects with their application to the actual designing of simple machines or parts of machines. Proofs of fundamental formulas and illustrations of common engineering details are omitted, since they can be found in standard works. The recommendations of the British Standards Institution have been followed in the drawings. (Sir Isaac Pitman & Sons, Ltd., London, 1951. 137 pages, 18s.)

Festigkeitsnachweis im Stahlbetonbau

Written by K. Jäger for use as either a text or reference work, this book is concerned with the mathematical analysis of the strength of reinforced-concrete structures, with a particular consideration for safety factors. Section I presents a mathematical treatment of multiaxia /states of stress, an analytical determination of the strength of concrete and steel, and the formulation of conditions which lead to failure. Subsequent sections deal with various load characteristics, stability and the effects of forces on reinforced-concrete structural members. Examples are given of actual evaluations of load conditions. (Manzsche Verlagsbuchhandlung, Vienna, 1948. 281 pages, $6.12, D.M. 25.70, Sw.Frs. 26.30.)

Irrigation Engineering, Volume I, Agricultural and Hydrological Phases

Engineering aspects are emphasized in this comprehensive work, by I. E. Houk, which presents basic principles, facts and practice. Special attention is paid to recent advances in such subjects as soil moisture, runoff forecasting, quality and constituents of irrigation water, and improved methods of applying water. Variable factors involved in irrigation work are discussed. Pertinent technical and statistical data are quoted extensively throughout the book. Project planning and structures are presumably to be dealt with in a separate volume. (John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1951. 545 pages, $9).

Materials Handbook

Practical data on approximately 9,000 materials arranged under several hundred major headings

are given in this standard reference work by G. S. Brady. The condensed information gives chief characteristics, sources, comparative data, uses, etc. There are a detailed 50-page index and a supplementary section giving basic information on weights, measurements, physical property ranges, definitions, and various useful tables. As with the successive previous editions, additional material and topics have been included to keep the contents up to date. (McGraw-Hill Book Co., New York, Toronto, London, 1951. 913 pages, $8.50).

(The) Miami Conservancy District

In a complete record of the conception and operation of this important flood control project, beginning with the story of the Miami River flood of 1913, A. E. Morgan tells how the plans and organization were developed to prevent a recurrence of the disaster. Full details are given on the selection of the engineering staff, the assessment of damages, specifications and bids, power sources, and the actual construction of the dams, reservoirs and other works. A chronological bibliography is appended. (McGraw-Hill Book Co., New York, Toronto, London, 1951. 504 pages, $6.50).

Pile Foundations Theory—Design—Practice

To provide in one source the information required for the design, driving and maintenance of pile foundations is the intent of this book by R. D. Chellis. Phases covered include relations between borings and soil mechanics and pile foundations, methods of determining pile capacities from driving resistances and friction values, selection of driving rigs, choice of pile types, evaluations of all types of piles and sheet piling, structural design of piles, discussion of factors causing deterioration in piles and protective methods, and methods of making and interpreting load tests. (McGraw-Hill Book Co., New York, Toronto, London, 1951. 681 pages, $12.50).

Standard Manual on Pipe Welding

Written primarily for the piping contractor, this comprehensive manual contains material of value to the architect and engineer as well. Welding equipment and processes are described, and materials and filler metals are thoroughly covered. Shop organization is discussed, and space is devoted to layout and fabrication details, including templets and jigs. Other topics considered are cost estimating, testing and inspection, selection and training of operators, and the scope of pipe welding. Welding terms and symbols are listed, and necessary tables and formulas are included. (Heating, Piping and Air Conditioning Contractors National Association, Suite 1401, Rockefeller Center, New York, N.Y., 1951. 506 pages, $7.50.)

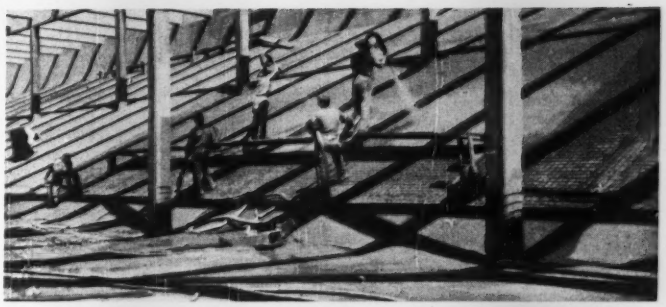
Stollen—und Tunnelbau

Modern practices in tunneling through solid rock and through unstable soil are discussed in this book by W. Zanoskar. The following factors are considered: Excavating procedures; the removal of rock in gallery excavation by drilling and blasting; the calculation of strata in tunnel construction; underground water; lighting, ventilating, energy requirements, and cost considerations. (Springer-Verlag, Vienna, Austria, 1950. 231 pages, $5.80 or D.M. 24 or £1.1s.)

Theory of Elasticity

The theory of elasticity must be used where the elementary theory of strength of materials proves insufficient, as in dealing with local stresses near loads and supports and in regions of sharp variation of cross section. This book, by S. Timoshenko and J. N. Goodier, presents the fundamentals of that theory with special reference to the needs of the engineer. The presentation considers both two- and three-dimensional problems. Photoelastic, soap-film and other experimental methods are in-

(*Continued on page 98*)



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We offer complete, prompt repair service on all makes of instruments — levels, transits, theodolites, etc.

Recent Books

(*Continued from page 97*)

cluded. The additions and revision of the current edition express the developments in the field during the 17 years since the previous edition was published. (McGraw-Hill Book Co., New York, Toronto, London, 1951. 506 pp., $9.50).

Tools of the Earthmover, Yesterday and Today, Preserved in Pictures

In this book, by J. L. Allhands, the various major types of earth-moving equipment are dealt with in turn, beginning with the simplest. Each chapter describes first the early methods of performing the operation and then shows the development to the present-day units. In addition to the actual moving and handling equipment there are chapters on the motor truck, on rock drills and pile drivers, and on crushing and screening plants. Hundreds of illustrations of ancient, transitional and modern equipment are included. (Sam Houston College Press, Sam Houston State Teachers College, Huntsville, Tex., 1951. 362 pages, $5).

Applications for Admission to ASCE, October 20–November 17

Applying for Member

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A. RALPH BONAVOGLIA, New York, N.Y.
STANLEY STEVEN CARNEGIE, Baton Rouge, La.
WILLIAM WOODROW DAVIS, Philadelphia, Pa.
GEORGE FLOYD FERRIS, New York, N.Y.
HOUGHTON ROSS HALLOCK, Fort Worth, Tex.
JOHN JACOB KASSNER, New York, N.Y.
FREDERIC LEWIS LAWTON, Montreal, Canada.
WILLIAM HALBERT MCKELDIN, Arlington, Va.
WILLIAM AUGUSTUS MCWILLIAMS, Dover, Del.
RUSTOM EDULJI MIRZA, Karachi, Pakistan.
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LINDSEY JAMES PHARES, Fair Lawn, N.J.
CEPHAS PERRY QUATTLEBAUM, Jacksonville, Fla.
JOSE DOLORES REYNA, Hato Rey, Puerto Rico.
ERNEST CHARLES ROEMER, JR., Tallahasse, Fla.
FREDERICK EDWARD DWIGHT SMITH, Baton Rouge, La.
THEODORE CALVIN TUCK, New York, N.Y.
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HYMAN BENJAMIN ULLIAM, Boston, Mass.

Applying for Associate Member

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ROBERT THOMAS FLYNN, Coulee Dam, Wash.
ABU ASAD MOHAMMAD OBAIDUL HAQUE, Dacca, Pakistan.
DAVID ARTHUR HOPKINS, New York, N.Y.
DONALD CLARK HULBERT, San Diego, Calif.
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JAMES ROBERT MONTGOMERY, Tyler, Tex.
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JOHN HEATH MARTIN, Jacksonville, Fla.
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MACK DARRELL MORRIS, Evansville, Ind.
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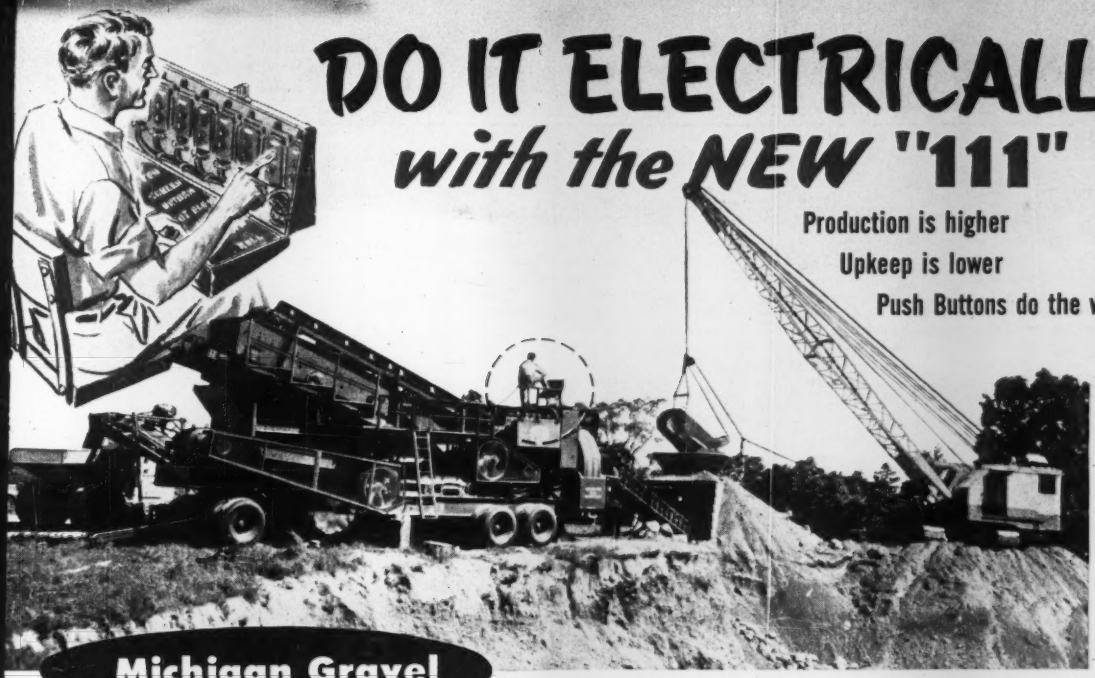
with the NEW "111"

Production is higher
Upkeep is lower
Push Buttons do the work

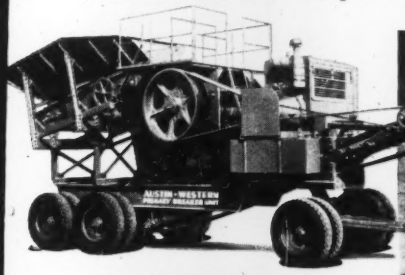


Michigan Gravel

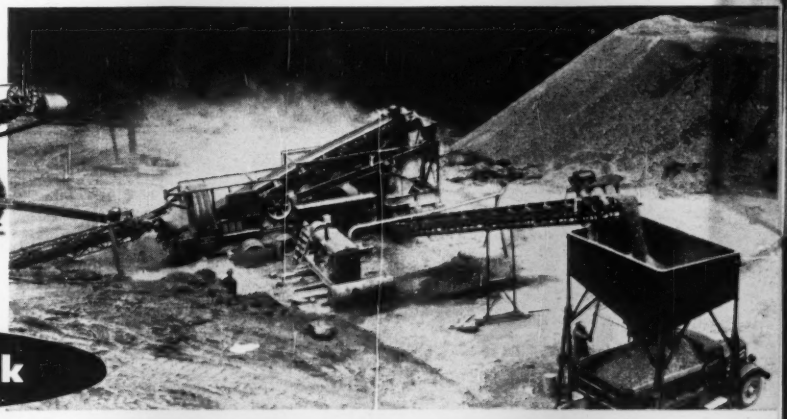
Production is higher—because each unit has its own electric motor drive; thus operates at top speed and efficiency at all times.

Upkeep is lower—because drives are simple and have few parts.

Push buttons do the work—the man on the platform starts and stops the feed and delivery conveyors, and has other units under complete control.



Primary Breaker units are made in several sizes; this one has a 3' x 10' apron feeder, 20" x 36" jaw crusher, power unit and delivery conveyor—all mounted on pneumatic tires.



Carolina Rock

The high production "111," with its 10" x 36" jaw and 40" x 24" roll crushers, is equally at home in gravel and rock. On this quarry job, production is still further increased by using a Primary Breaker unit with 32" x 40" jaw crusher (not visible in the photograph) to reduce the oversize to about 5 inches.

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BALDWIN BLH LIMA-HAMILTON

EQUIPMENT, MATERIALS and METHODS

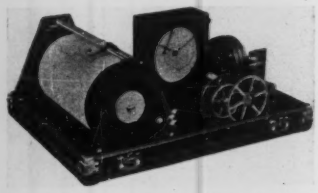
NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Concrete Curing Compound

A FAST DRYING, spray-on concrete curing compound that will effectively seal 200 sq ft of horizontal surface per gallon, has been developed. The product, known as Permite W-95, has already found a wide use in Army and Navy Air Force projects. Information, including engineering data and moisture resistance chart, may be obtained by writing **Aluminum Industries, Inc., 2438 Beekman St., Cincinnati 25, Ohio.**

Recording Micro Barograph

A RECORDING MICRO BAROGRAPH, recently developed, is easy to use and produces dependable results to a degree of accuracy never before attained. The instrument is of utmost importance to geophysicists, geologists, surveyors and engineers in the oil and mining fields and many others in government bureas, educational institutions, weather stations, aviation, the maritime industry and research laboratories. The Micro barograph is constructed on the nul or zero-gauging principle, using the same pressure-sensitive device incorporated in the company's other instruments. All power in the actuating and recording mechanism is supplied by two heavy duty sealed instrument clocks and no power is taken from the pressure-sensitive device. The Micro barograph

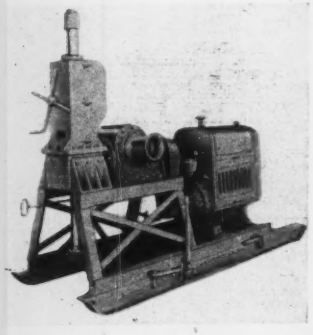


High Degree of Accuracy

records a pressure curve over a range of plus or minus 1.00 in. mercury and can be used at any elevation from sea level to 10,000 ft by means of a convenient reset. The 24-hr chart is graduated in intervals of 0.005 in. merc., easily read to 0.001 in. merc. Chart time is divided into intervals of 10 min., readable to 1 min. Curve is drawn on a specially surfaced paper by a metallic point and no ink is used. Precision graphs are supplied with each instrument for the purpose of converting readings to the closest 1 ft elevation where instrument is used as a base recorder for altimeter surveys. This procedure makes unnecessary the current practice of maintaining a man at base. Weight of the Micro barograph, complete with recording thermometer, charts and carrying case is about 30 lbs. **American Paulin System, 1847 South Flower St., Los Angeles 15, Calif.**

Shot Core Drill

THE SHOT CORE DRILL designated as the Model KR is a modern, efficiently engineered core drill designed to recover cores from any formation—hard or soft up to 20 in. in diameter and depths down to 600 ft. It incorporates all of the features made necessary by modern drilling and testing techniques. Because shot bits are run to destruction and bit maintenance is negligible, operation is exceptionally economical, particularly in cores 3 in. and over. Operation is simple and no special skill or



Model KR

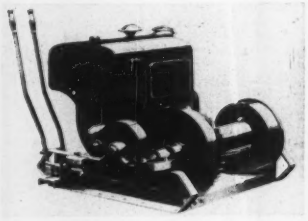
experience is required of the operator. Drilling is always under the complete control of the operator, who can, when necessary, instantly switch to any one of three speeds. The KR basically consists of a heavy duty rotary drill head with a three speed transmission, a cargotype hoist and a gear driven positive displacement pump. An effective shot feed system carries the shot down the interior of the drill rods directly to the cutting bit. Drill cuttings are flushed to the surface. The entire unit can be mounted on drag skid, trailer or truck. Power can be supplied from power take-off of a jeep or truck, gasoline, kerosene or diesel engine, air or electric motor. A 15 or 25 ft derrick can be supplied with the unit and for portability the complete unit with tower can be mounted on jeep, trailer or drag. The KR is especially suited for drilling tube and artesian wells, in hard formations. For subsurface exploration, the KR will recover cores from any substance ranging from sand to granite. The KR drill is particularly successful in recovering test cores from highways, airfields or large masonry or concrete structures. Steel reinforcement bars offer no obstacle to the KR shot core drill. Large size test cylinders are quickly and easily recovered from concrete having such reinforcement. **Acker Drill Company, Scranton, Pa.**

Rock-Type Tire

A ROCK-TYPE TIRE designed particularly for graders operating where there is considerable rock or under especially tough conditions is announced. There is a definite need for this specialized tire because of the growing use of special tractors, graders and motor patrols in quarries and other types of service where cutting of the casing is a particular problem. Made for semi-drop center rims, the tire fits rim size 800 T, has a cross section 13.2 in. wide with an outside diameter of 50.8 in., maximum rated load of 6600 lbs when inflated to 50 lbs pressure, and makes 426 revolutions per mile, all of the data being based on a maximum speed of 25 mph. **B. F. Goodrich, Akron, Ohio.**

Hydraulically Controlled Hoist

A SERIES OF HOISTS has been introduced. Hoisting control is obtained thru the use of an oversize hydraulically operated clutch. External contracting 3 in. band brakes are used to insure safe stopping power. Automatic safety ratchets used in conjunction with the brake are standard equipment on all models. Model 2500-H has a capacity of 6000 lbs at 100 fpm as standard. Wide range of speeds and capacities are avail-



Model 1300-H

able. Power is a 25 hp Wisconsin gasoline engine. Model 1300-H has capacity of 3000 lbs at 100 fpm as standard gearing and also has a wide range of speeds and capacities. Power is a 13 hp Wisconsin gasoline engine. All units are equipped with anti-friction ball and roller bearings to reduce friction loss to a minimum. Multiple drum units are available at additional cost. All drums have ample space for wire rope. Gasoline, electric, and diesel power units can be used with the King frames. The hoisting frames can be purchased separately. The hoists are ideal for dockside and warehouse loading and stacking, underground slushing and scraping operations, logging, pit and larry car hauling, and other hoisting and hauling operations. **King Manufacturing Corp., 3146 W. Chicago Ave., Chicago 22, Ill.**

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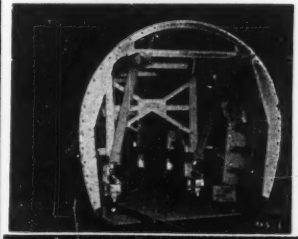
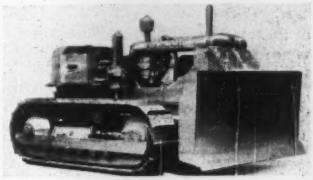


MAYO
TUNNEL & MINE EQUIPMENT
Robert S. Mayo
Civil Engineer
LANCASTER, PA.

Equipment, Materials & Methods (Continued)

Bulldozer

DEVELOPMENT OF THE first successful big-capacity, no-pushbeam bulldozer is announced. The unit embodies the first radical change in industrial dozer design since Baker pioneered the hydraulic control bulldozer in 1926. The bulldozer literally lowers and raises itself by "its own bootstraps." Designated the 9-X, it mounts on a standard 9-ton, 70-drawbar hp Allis-Chalmers crawler tractor. The revolutionary design of the unit eliminates conventional push beams. Dozer and engine frame are an integral unit permitting immediate blade response through double-acting hydraulic cylinders, which raise and lower tractor and blade between



Baker 9-X

the tracks. The connections at the piston end, to the truck frame, through a new type linkage, represent one of the major engineering achievements. Utilizing this design permits a dozer blade only 8 ft wide, which is the maximum width permitted on the highways without special permit. The 96-in. blade is 6 in. higher than standard models. This height, plus the design of the blade itself, permits the 9-X to handle approximately the same load as standard dozers of the same horsepower rating. The Baker 9-X weighs only 3400 lbs and requires approximately 1150 lbs less steel than comparable models. **The Baker Mfg. Co., Springfield, Ill.**

Collapsible Air Diffuser

THE COLAFLEX AIR and gas diffuser is a new type of equipment for fine diffusion of air or other gas into a liquid in sewage and industrial waste treatment, water conditioning, biological manufacturing processes and absorption processes. An important feature is the ease with which the flexible fabric diffusing elements can be cleaned and their permeability maintained. Operation of a three-way valve shuts off air or gas pressure, and liquid pressure then inverts the element down into its receptacle. This flexing of the fabric dislodges solid particles on or in the fabric, keeping it clean. The system is adaptable to many different types and sizes of installation. **Infilco Inc., Tucson, Ariz.**

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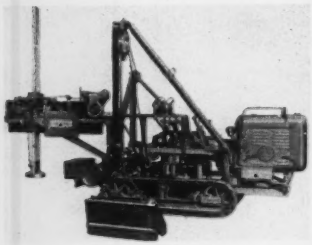
Equipment, Materials & Methods (Continued)

Flooring

THE MEDLEY BLOCK, a new type of flooring is now being manufactured. Designed primarily to be laid on concrete slab and plywood subfloor construction, the block is unique in that it is flexible in both directions, allowing it to go down firmly over minor imperfections in the subfloor. This type of parquet is made of selected hardwood bonded to 30 lb asphalt-impregnated felt membrane. It is laid in the conventional manner with cold mastic. **H. G. Macdonald Company, Monrovia, Calif.**

Versatile Side-Crane

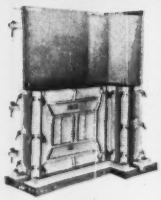
THE MODEL 80 is a one-man operated machine that tamps, backfills, lays pipe, unloads and handles pipe, sheathing, etc., and does all types of light crane work. The versatile machine is mounted on a crawler having 24 separate travel speeds, ranging from 1 ft per min. up to 2½ mph, coupled with high stability and utmost maneuverability. Three-way simultaneous action—it tamps, as it backfills, as it travels—makes for unusual speed and efficiency in these operations. The Model 80 tamps while traveling either along the side of the trench or straddling it. The tamper delivers a 380 ft lb blow, 45 times each minute, compacting the earth in layers



Model 80

that are 3 to 4 times thicker than is practical by air or hand tamping. Because its compacting ability is so great, pavement may be relaid immediately without danger of settling. The Model 80's backfiller is a conventional dragline type with a telescopic boom. It backfills from either side of trench, from the side on which spoil bank is located or from the opposite side. This versatility makes it usable on practically every trench job. All of the light crane duties involved in trench operations are within the scope of the Model 80. Without extra counterweights, it will lift a weight of 6,000 lbs, located 3 ft from the edge of the crawler track. Standard boom sections are extendable to 15 ft. The Model 80 is also available as a backfiller-side crane only, with provision made for the addition of the tamper unit at a later date. **The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland, Ohio.**

Save manpower time and material



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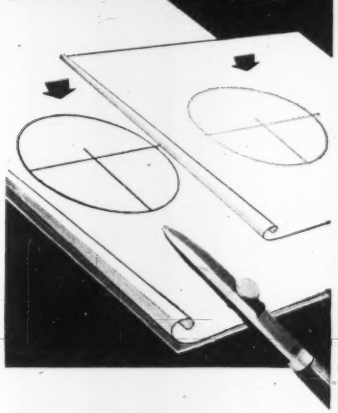

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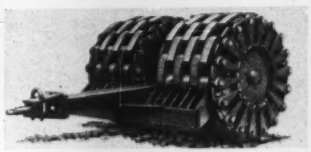
Equipment, Materials & Methods (Continued)

Variable Pressure Compactor

THE CONVENTIONAL sheepsfoot roller does not finish the job when compacting road or airodrome landing-strip subgrades. A top layer of disturbed or insufficiently compacted soil remains and has to be dealt with by other means—generally not as efficient as sheepsfoot rolling. The Albaret Turnfoot roller does away with



Turnfoot Roller

this difficulty thanks to progressive bottom-to-top compaction with three successive foot positions. The feet, of special design, are fitted to circumferentially spaced rotable shafts. Turning these shafts a certain angle brings the desired foot-base into operation after which the shaft is keyed in position by a simple device. Shifting from one foot-position to the other is effected in less than $\frac{1}{4}$ of an hour for all feet on the two drums. Efficient steel plate cleaners insure total absence of clotting up. Positions 2 and 3 can be used for finishing compaction of surface "fluff" left over during deep compaction in Position 1, thus securing complete bottom to top compaction of each layer. Position 3 is as much a rolling as a tamping position and can also be used when it is desired to haul the Turnfoot from one spot to another without damage to finished surfaces. In all, the Turnfoot roller is a three-in-one tool capable of completing a compaction job from start to finish. It can be hauled by a motor-grader and is the best means for economical and efficient compaction yet devised. **Ets. Albaret, Rantigny (Oise) France.**

Hyspeed Winch

DESIGNED TO SUPPLY increasing demand for a lightweight, free-spooling tractor winch with fast line speeds and quick positive brake action a completely new D4 Hyspeed winch has been developed. The winch can be mounted on either seat or fender tank type "Caterpillar" D4 tractors. The Hyspeed winch has many applications as a production tool, as well as for service, maintenance and general utility. A few of the jobs it will perform are lifting, pulling, crane work, light pile driving, ground skidding logs, bundling pulp logs, skidding bundled pulpwood and for "feeder cat" work in logging. An important application possible with the winch is the new method of forming and transporting bundles of pulpwood logs developed by Hyster. **Hyster Company, 2902 N. E. Clackamas St., Portland 8, Ore.**

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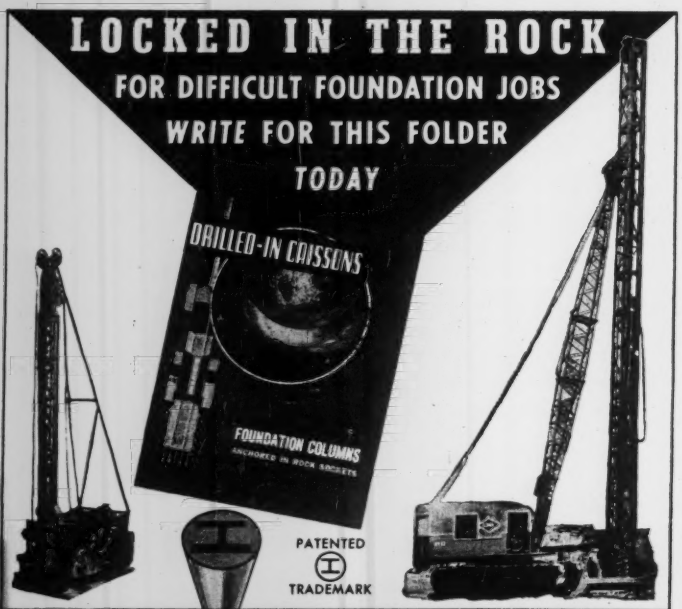

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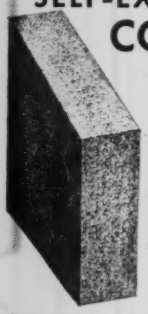

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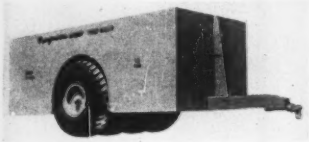

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this roller in compaction of earthfill dams, fills for airfield runways, caliche and crushed rock. They are now being used in large numbers on overseas airport installations as well as in the United States. They are furnished for either sand or cast-iron ballast. Extremely simple in design, maintenance is held to an absolute minimum. **Shovel Supply Company, Box 1369, Dallas, Texas.**

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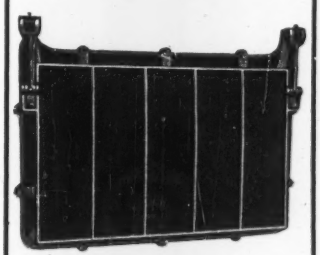

Fig. B-61. Type M-M

Type M-M (Rectangular) Tide Gates are available in 37 sizes from 8″ x 8″ to 96″ x 96″. Bulletin No. 71 describes them fully.

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Literature Available

FUSION WELDING—A booklet, designated as Technical Bulletin T-2, on the fusion welding of nickel and the high nickel alloys has just been published. It contains 44 pages and includes more than 30 tables and almost 50 drawings and photographic illustrations. **The International Nickel Co., 67 Wall St., New York 5, N. Y.**

STUDY OF WATER HAMMER—The cause, effect and control of water hammer in piping systems are considered in an 8-page bulletin. After describing water hammer in non-technical terms, the brochure indicates its potential damage to piping, instruments and other parts of water systems, and then considers methods of controlling it. Ask for bulletin No. WH 851. **The Williams Gauge Co., 1620 Pennsylvania Ave., Pittsburgh 33, Pa.**

CONCRETE TESTING MACHINE—A 2-page bulletin, No. 327, presents concrete testing machines of 100,000 lb capacity. The bulletin covers features, including hydraulic loading, independent hydraulic load weighing, accessories, and specifications. **Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.**

CRANE AND YARD SHOVEL—Catalog 20-51, on the Model 2000, 25 ton crane and 1-1/4 yd shovel has just been released. Twelve pages of details and photographs, with a full color cover, describe the machine and its advantages. Individual diagrams show working ranges for crane, hoe, and standard and high lift shovel front end attachments. Crane capacity charts covers the full lifting range from 25 tons at 12 ft radius to 100 ft boom at 70 ft radius. **Manitowoc Engineering Works, Manitowoc, Wis.**

ELEVATING TOWER FOLDER—A descriptive folder announcing the introduction of a lightweight, low-cost material-handling elevating tower, Model III Type PT is available. The tower has 3,000 lbs capacity, is panel-type, made of lightweight tubular steel, and is especially quick to erect in confined places. Write for Bulletin No. 734, **American Tubular Elevator Co., Zelienople, Pa.**

GIANT SIZE CALENDAR—The Post 1952 weekly wall calendar brings you interesting weekly messages for the draftsman. Each of the 52 pages has a coupon that can be filled out and mailed in requesting quotations and samples of engineering and drafting materials as well as free good will items such as handy decimal equivalent decals for the T square or drawing tabic, giant conversion and decimal equivalent charts—and there is also a reminder check-up list, designed to save you time in re-ordering your engineering supplies and equipment. It is available in full four-colors, suitable for framing, without any advertising matter. The giant size dates on this calendar can be seen clear across the room yet the outside dimensions of the calendar require a minimum of wall space. **The Frederick Post Company, Dept. Z, P. O. Box 803, Chicago 90, Ill.**

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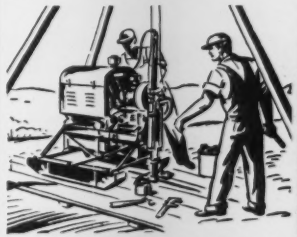

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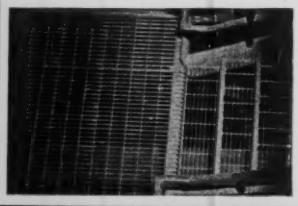

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Literature Available (Continued)

MIXERS—A 24-page truck mixer bulletin on horizontal and adjusta-hite motomixers is announced. The bulletin has detailed, concrete information which every operator interested in pre-mixed and truck mixed concrete will want to know. Ask for 51-29, **Chain Belt Company, 1600 W. Bruce St., Milwaukee, Wis.**

TECHNICAL BOOKLET—A booklet on the resistance welding of nickel and high nickel alloys has been issued. Designated as Technical Bulletin T-33, it contains 32 pages illustrated throughout by drawings and photographs. It also presents tables on mechanical properties, chemical compositions, recommended conditions for welding and other information. **Development and Research Div., International Nickel Co., Inc., 67 Wall St., New York 5, N.Y.**

GRAVEL ROADS—Who can be sued for an automobile accident caused by loose gravel? This and other subjects concerning unstabilized gravel roads are discussed in an 8-page bulletin just issued. The booklet treats also the cost of stabilization versus the savings possible in lower maintenance and in the elimination of gravel losses. Write for the bulletin, "Stabilize Gravel Roads." **Seaman Motors, Inc., 305 N. 25th St., Milwaukee, Wis.**

STANDARDS BULLETIN—Standards Bulletin No. 1 lists all the various types and sizes of core drill equipment in general use for which standards have now been written in whole or in part. The publication clearly shows these parts, with cutaway drawings and nominal dimensions. Standards Bulletin No. 1 represents the collected knowledge, experience and thought of the 16 member companies of the Diamond Core Drill Manufacturers Association, following the work of the Association's technical committee. The work is being continued and as further standards are approved from time to time, revisions of the bulletin will be issued. Copies may be obtained at a cost of 50¢ each from **Diamond Core Drill Manufacturers Assoc., 122 East 42nd St., New York 17, N.Y.**

AERIAL SURVEYING—A booklet entitled, "Aerial Surveys and Maps from Photographs," presents a brief non-technical explanation of aerial photogrammetry. The various products that are made from aerial photographs and ways in which aerial mapping can save time and money on engineering projects are shown. The photogrammetric process is diagrammed, and several pages illustrate the planes and cameras used in aerial photography, and the instruments used in the laboratory processing. Also, various maps and photographs that are available from aerial surveys are illustrated and explained along with the uses that can be made of each type. **Abrams Aerial Survey Corporation, 606 E. Shiawassee St., Lansing 1, Mich.**

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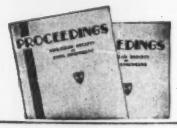

PROCEEDINGS AVAILABLE

The following papers, printed as Proceedings Separates, may be ordered on the basis of summaries given in this and previous issues of CIVIL ENGINEERING. Discussions of these papers will be received, as in the past, for a period of five months following the date of issue. A summary of each paper appears in several consecutive issues; other titles will be added every month, as they become available. Use the convenient order form on page 108.

Summarized in Earlier Issues

87. Sewage Reclamation by Spreading Basin Infiltration, by Ralph Stone and William F. Garber.

88. Experimental Study of Water Flow in Annular Pipes, by W. M. Owen.

89. Deflections in Gridworks and Slabs, by Walter W. Ewell, Shigeo Okubo, and Joel I. Abrams.

D-30. Discussion of Paper, **Economic Effects of Reservoir Sedimentation,** by William E. Corfitzen.

D-40. Discussion of Paper, **Construction Technique of Passing Floods Over Earth Dams** by Andrew Weiss.

D-34. Discussion of Paper, **Lateral Buckling of Eccentrically Loaded I-Section Columns,** by H. N. Hill and J. W. Clark.

D-38. Discussion of Paper, **Hydrology of Mexico,** by Andres García-Quintero.

D-17. Discussion of Paper, **Origin and Significance of Openwork Gravel,** by Allen S. Cary.

D-33. Discussion of Paper, **Strength of I-Beams in Combined Bending and Torsion,** by Basil Sourochnikoff.

Third Notice

90. Consumptive Use of Water by Forest and Range Vegetation, by L. R. Rich.

91. Consumptive Use of Water, by Harry F. Blaney.

92. Experimental Investigation of Fire Monitors and Nozzles, by Hunter Rouse, J. W. Howe, and D. E. Metzler.

93. Aircraft Design as Related to Airport Standards, by Milton W. Arnold.

94. Friendship International Airport, by Benjamin Everett Bevin.

95. Directional Requirements for Airport Runways, by Ralph H. Burke and Harry Otis Wright, Jr.

96. Surface Curves for Steady Nonuniform Flow, by Robert B. Jansen.

D-36. Discussion of Paper, **Impossibility of Performance in Contracts for Engineering and Construction,** by Robert F. Borg.

D-39. Discussion of Paper, **Practical Design of Solid-Barrel Reinforced-Concrete Skew Structures,** by Bernard L. Weiner.

D-42. Discussion of Paper, **Wind-Load Standards in Europe,** by John W. T. Van Erp.

D-43. Discussion of Paper, **Settlement Correction at La Guardia Field,** by John M. Kyle.

D-44. Discussion of Paper, **The Problem of Wave Action on Earth Slopes,** by Martin A. Mason.

Second Notice

97. Consumptive Use in the Rio Grande Basin, by Robert L. Lowry. With most of the available water in all of the streams of the southwestern United States already appropriated and used for irrigation, about the only remaining source of water for further expansion in irrigation lies in the possible conversion of present nonbeneficial uses to beneficial uses. The special case of irrigation along the Rio Grande between El Paso and Fort Quitman, Tex., shows what has been accomplished in this line along that stretch of river, and points the way to similar improvements that may be of profit to other projects. (Available December 1.)

98. Consumptive Use of Water on Irrigated Land, by Wayne D. Criddle. Water is consumed by growing crops through transpiration, evaporation from the vegetation and surrounding wetted soil, and in the building of plant tissue. The water so consumed is, therefore, not available in the streams for power, navigation, municipal water supplies, or irrigation purposes. Thus, a knowledge of the amount so consumed by various crops and other uses is extremely important in our planning for future development and operation of our streams. This paper gives a range in the amount of water consumed by various types of vegetation under different climatic conditions in the United States. That portion of the consumptive requirement contributed by precipitation at several western locations is indicated, together with a suggested method for determining peak rates of water use for irrigation system design purposes. (Available December 1.)

99. Consumptive Use in Municipal and Industrial Areas, by George B. Gleason. In order to determine a fair distribution of water rights in the Raymond Basin Area, Pasadena, Calif., a survey was conducted to determine the consumptive use of water. The results of this study are presented and the data analyzed to emphasize factors that may be of assistance in the planning and execution of similar surveys. (Available December 1.)

100. Forced Vibrations of Continuous Beams, by Edward Saibel and Elio D'Appolonia. The determination of the forced oscillations of a continuous beam caused by an exciting force is presented in this paper. The procedure requires only a knowledge of the eigenfunctions and eigenvalues of the beam from which all intermediate points of support have been removed (a simple beam). Solution are found for forced oscillations and constraints are introduced in the form of undetermined multipliers. The cases of fixed and free vibrations are treated, and a numerical example is presented. (Available December 1.)

101. Application of Highway Capacity Research, by J. P. Buckley. Dealing with the complex problem of capacity determination for all sections of all road and street systems in an entire state requires the use of simplified methods. The development and use of comprehensive capacity charts in the Ohio highway planning survey are discussed and illustrated for the cases of two-lane rural roads, two-way city streets, and one-way city streets. Capacity data allow the engineer to be more realistic in determining corrective measures that can be employed to relieve congestion. (Available December 1.)

102. Utilization of Ground Water in California, by T. Russel Simpson. California is

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5. Discussions of each paper, with author's closure, also will be published as a Separate and must be ordered in the same manner as other Separates, except that no charge will be made for the discussions of a paper previously ordered. The order form will list available discussions of papers. Discussions will be numbered to agree with the basic paper.

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far ahead of other states in development of its ground-water resources. It also has a proportional share of the nation's ground-water problems that require water conservation for solution. The paper presents an account of current uses of ground water, segregated by major hydrographic areas of the state, and the over-all ground-water conditions of the state are appraised insofar as basic data are available. Certain areas are indicated in which further ground-water supplies may be developed, and other areas are indicated in which present draft must be reduced or additional water obtained either by local conservation or by importation. (Available December 1.)

103. Pile Foundations for Large Towers on Permafrost, by L. A. Nees. The development of natural resources in the far North has opened up new and unusual problems for the engineer, especially in the design of foundations and substructures. In particular, the prevalence of saturated fine-grained permanently frozen soils requires determination of strengths of such soils in their frozen state and the analysis of how a proposed structure affects their thermal regimen. This paper opens up for the engineer a perspective on the general problem by indicating the results of laboratory pile tests in frozen soils and presenting a method for computing the heat transmission and designing pile foundations in frozen soils. (Available December 1.)

104. Redesign of Major Airport Terminals, Herbert H. Howell. The accelerated growth of air transport is already over-taxing the capacity of many airports, and developments in electronics and air traffic control offer a means of increasing capacity, providing the airport itself can accommodate the volume. Most existing airports are susceptible to redesign so that acceptance rate and capacity are increased. As a specific example, revisions to the 1944 master plan for the Lambert-St. Louis Municipal Airport based on new techniques in airport design and air traffic control are described. (Available December 1.)

105. Principles of Highway Capacity Research, by O. K. Normann. Highway capacity design problems are usually solved by empirical factors developed by the road builder. The results of research in highway capacity have been summarized in this paper to present some factual design data. A listing is made of the types of investigations conducted, and the factors of desired speed and practical capacity are related to the effects of various limitations. (Available December 1.)

D-37. Discussion of Paper, **Design of Prestressed Tanks,** by J. M. Crom.

D-47. Discussion of Paper, **Operation and Maintenance of Irrigation Systems,** by Raymond A. Hill.

First Notice

106. Analysis of Ground Water Lowering Adjacent to Open Water, by Stuart B. Avery, Jr. A theoretical analysis of ground water lowering adjacent to open water is presented. The formulas and graphs included permit rapid computation of pumping rates required for various drawdowns and arrangement of wells. Computed values are compared to those observed on an actual well installation. (Available January 1.)

107. Characteristics of the Solitary Wave, by James W. Daily and Samuel C. Stephan, Jr. The solitary wave—with a single elevation and a constant velocity—is important because it occurs in a number of natural circumstances with sufficient consistency to make it useful in the prediction of wave action for design purposes. The authors explore the accuracy of wave theory in terms of available test data and conclude that they verify the Boussinesq-Rayleigh celevity equation reasonably well. (Available January 1.)

108. Control of Embankment Material by Laboratory Testing, by F. C. Walker and W. G. Holtz. The behavior of soils in earth dams during construction and subsequently is compared with properties determined by laboratory tests. Procedures are given for evaluating the effect of coarse-grained particles on the behavior of impervious soils, and a method for controlling and placing pervious soils is described. The development and control of pore pressures during construction are explained. Methods for determining pore pressures to be expected for given placement conditions are described, and field control procedures to restrict pore pressures are defined. Examples illustrate the effect of good construction control. (Available January 1.)

109. Final Foundation Treatment at Hoover Dam, by A. Warren Simonds. The unprecedented height of Hoover Dam with the extremely high head of water against the foundations and abutments created problems in design that were not subject to exact analysis. The foundation treatment was based on experience and precedent. Pressure grouting and drainage were relied upon to produce an adequate foundation. When the reservoir filled, leaks developed at unexpected places, excessive flows of water were discharged from certain foundation drains, and the uplift pressure on the base of the dam increased until its value exceeded that used in the design assumptions. This paper describes the corrective measures necessary to make the structural conditions agree with the original design assumptions. (Available January 1.)

110. Review of Flood Frequency Methods, final report of the Subcommittee of the ASCE Joint Division Committee on Floods. Factors that affect the accuracy of flood-frequency prediction are presented, and the limitations of the various known approaches to the problem are recorded. The report contains a description of the several methods in use for construction flood frequency curves. (Available January 1.)

111. Research in Water Spreading, by Dean C. Muckel. It has recently been proposed to recharge ground water supplies by spreading on soils of fine texture. This paper describes the problems involved in obtaining satisfactory infiltration rates and research done in altering the infiltration rate curves as found on undisturbed soils. Results of tests made on small ponds are reported under one of five general types of treatment (1) chemical, (2) mechanical, (3) operational procedures, (4) vegetative, and (5) addition of organic matter. Infiltration rates were increased materially by the addition of organic matter. (Available January 1.)

D-49. Discussion of Paper, **Large Hyperbolic Functions Computed by Fission,** by F. T. Llewellyn. Proceedings-Separate No. 59 (December 1950) explained a simple application of hyperbolic sines and cosines for the solution of structural problems by slide-rule, which is more precise and more rapid than that of interpolation by proportional parts. Discussers are: John Sherman, K. L. Cooper, and F. T. Llewellyn. (Available January 1.)

D-54. Discussion of Paper, **Truss Deflections by the Coordinate Method,** by Kuang-Han Chu. In Proceedings-Separate No. 54 (January 1951) Mr. Chu offered for discussion a simplified method that is an algebraic equivalent of the Williot-Mohr diagram. It can be carried to any degree of accuracy. Those who discussed were: L. C. Maugh, and Kuang-Han Chu. (Available January 1.)

D-61. Discussion of Paper, **Structural Damping in Suspension Bridges,** by the late Friedrich Bleich and L. W. Teller. A careful correlation between theory and experimental data on frictional damping of structural members. (Proceedings-Separate No. 61, March 1951.) R. K. Bernhard, George S. Vincent, F. B. Farquharson, Arne Selberg, and the late Friedrich Bleich and L. W. Teller discussed this paper. (Available January 1.)

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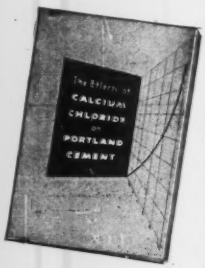

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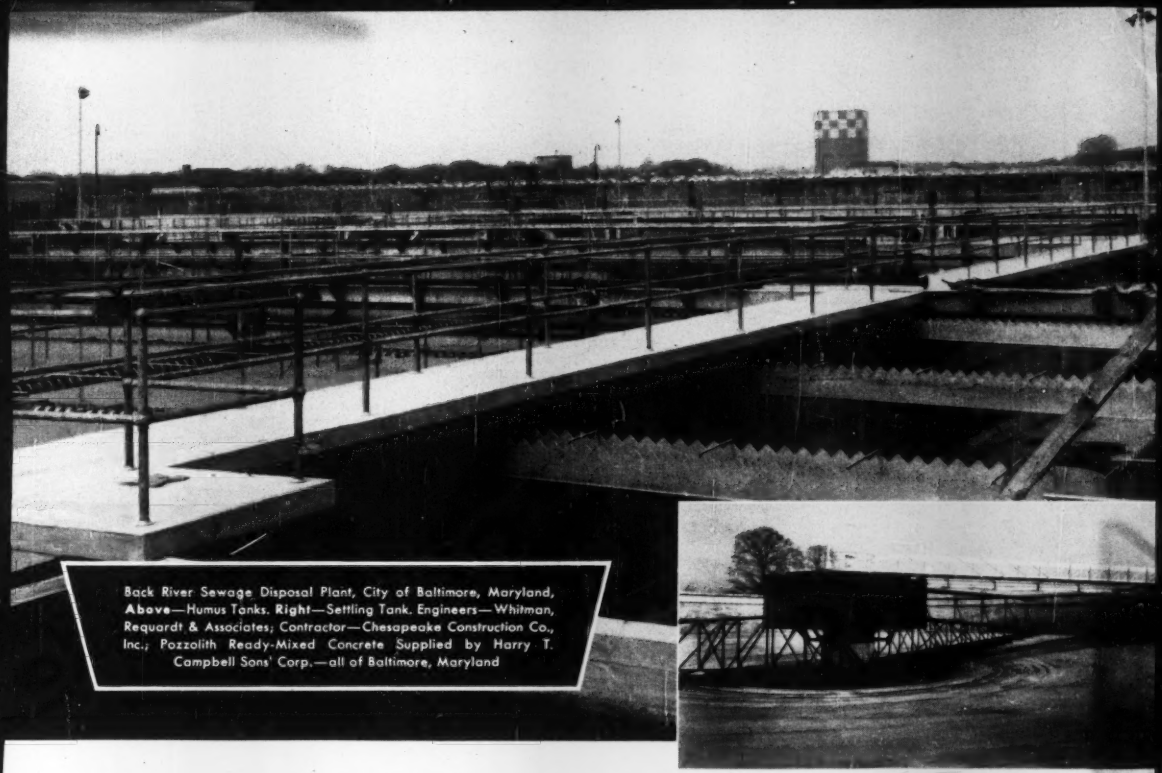

Back River Sewage Disposal Plant, City of Baltimore, Maryland, **Above**—Humus Tanks. **Right**—Settling Tank. Engineers—Whitman, Requardt & Associates; Contractor—Chesapeake Construction Co., Inc.; Pozzolith Ready-Mixed Concrete Supplied by Harry T. Campbell Sons' Corp.—all of Baltimore, Maryland

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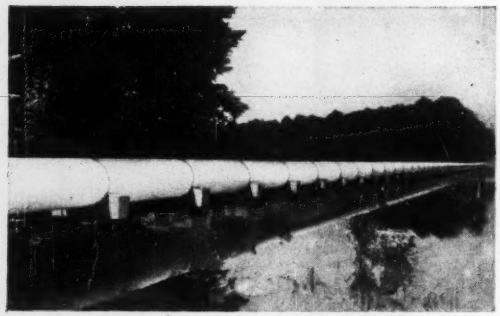
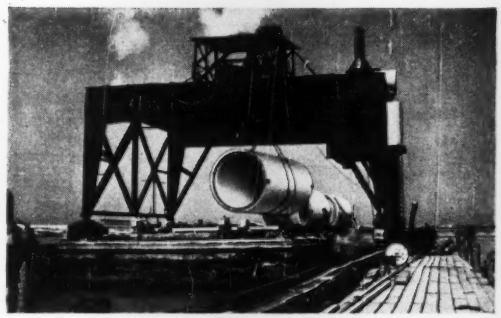


Lee Hall Reservoir crossing, part of the 237,400′ of 24″, 27″, 34″ and 39″ Lock Joint Reinforced Concrete Cylinder Pipe supplying water to the Newport News shipyards.



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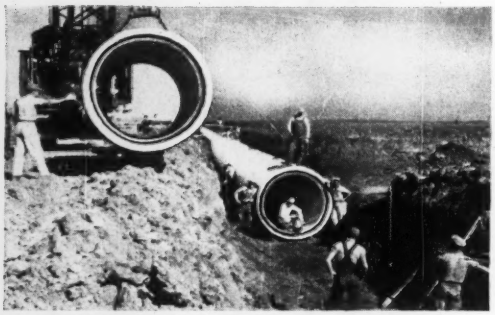

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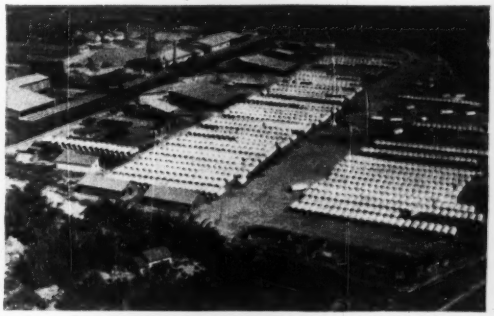

Lock Joint plant where 233,000′ of 69″ and 66″ Prestressed Concrete Cylinder Pipe were manufactured for the Rio de Janeiro water supply line.

The building of a water supply line represents a large and extremely important investment. For this reason every effort is made to select the most dependable and permanent type of pressure pipe for the project. Investigation to determine the most reliable pipe available will show that Lock Joint Concrete Pressure Pipe has proven its superiority by years and years of unparallelled performance.

The permanence of Lock Joint Pipe eliminates any necessity for replacement of the line. The conservative design of its steel reinforcement avoids the dangers of blow-out or rupture while providing an ample safety factor for unusual internal pressures and heavy backloads. Dense concrete walls prohibit tuberculation or corrosion and assure extreme durability and life-long high carrying capacity.

In short, Lock Joint Concrete Pressure Pipe provides permanence, efficiency and safety for one of the most vital and essential public utilities. For your next water supply project involving pipe 16″ in diameter or larger, specify Lock Joint—the pressure pipe whose future has been proven by its past.

LOCK JOINT PIPE COMPANY

Est. 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plants: Wharton, N. J., Turner, Kan., Detroit, Mich.

BRANCH OFFICES: Cheyenne, Wyo. Casper, Wyo. • Denver, Col. • Kansas City, Mo. Walley Park, Mo. • Wichita, Kan. • Chicago, Ill. Rock Island, Ill. • Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. • Tulsa, Okla. Oklahoma City, Okla. • Beloit, Wis. • Hato Rey, P. R.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.